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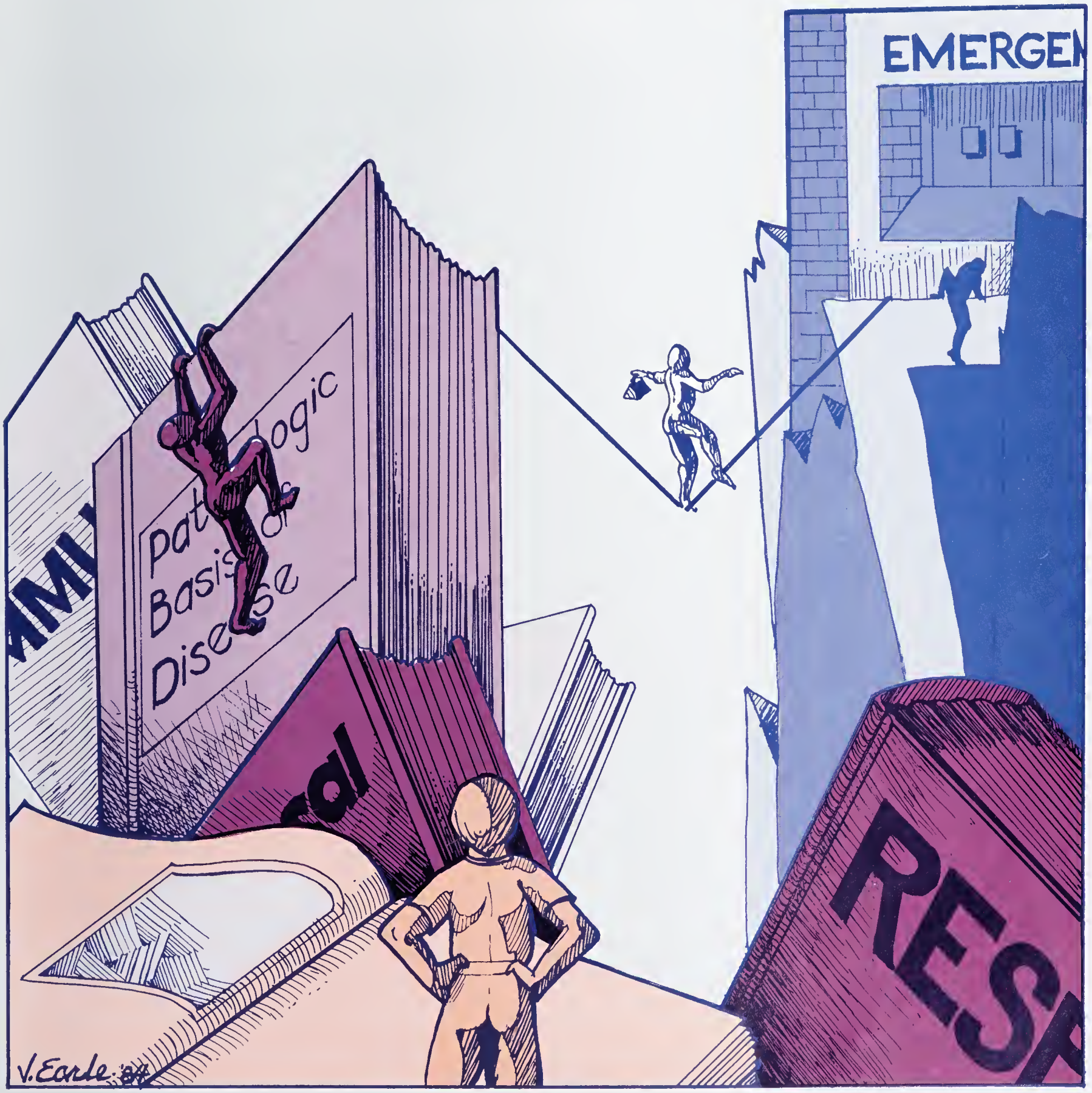

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University of Toronto
MEDICAL JOURNAL

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GUIDELINES FOR PUBLICATION

1) All articles intended for publication should be submitted to the editors before the deadline which is usually six weeks before the release of the Journal.
2) Submitted articles should be typed (or legibly printed) double-spaced, single-sided on paper 8½" x 11" (letter size) and they should not be more than 20 to 30 pages (5000 to 6000 words).
3) Illustrations, graphs, diagrams and figures should be put on a separate sheet and identified by Arabic numerals. A list of explanatory legends for all the figures and diagrams should be put on another sheet. Do not write on the back of photographs.
4) References should be checked with the original sources, designated by raised Arabic numerals in the text, and listed in alphabetical order on a separate sheet. Each periodical reference should include in order: the author's last name and initials, title of the article, journal name, volume number, page number, and year (e.g. Risser JC: Scoliosis: Past and Present. *J. Bone and Joint Surg* 46 A:167, 1964). For further information please consult the MLA Stylesheet.
5) The editors reserve the right to make changes as they see necessary to ensure correctness of grammar and spelling and clarification of statement and conformity. Those views expressed in the commentary do not necessarily reflect the views of the Journal staff.
6) Acceptance for publication is subject to the understanding that such material is submitted solely to the Journal and will not be reprinted without the consent of both the editors and author.

The Medical Alumni Association is the bridge between the graduates and the Faculty of Medicine, University of Toronto.

During your undergraduate years, the Association was involved with providing financial assistance (scholarships, bursaries, travel grants, fellowships, loans) as well as sponsoring programs that were of particular interest — General Practice Panel, Arts and Letters Committee, Undergraduate Affairs, Graduation Banquet, etc. Now that you have graduated, the Association is still able to offer financial assistance in form of bursaries and loans; as well as being your representative at the Faculty and University level.

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MEDICAL ALUMNI ASSOCIATION

EDITORIAL

On The Responsible Physician

M.J. Bazos

Mason Williams, a reknowned poet and philosopher, once said "You will know me by my touch — it is the last." Many physicians and medical students have clutched the hand of a dying patient in their deathbed and have felt the last grope for life drain from the doomed body. Whatever hopes, desires and aspirations, regrets and disappointments, that patient had (for the last time) was felt and was relayed by this special and last "touch." A comforting touch to a wretchedly miserable patient conveyed a great deal of emotion between the two parties. Consolation, and a feeling of ease and contentment interchanged between these two people. The question is how should that responsible physician or medical student reconcile his sense of mercy and compassion with his sense of professional judgement, or for that matter survival?

Since the days of Hippocrates, the physician has had to bear certain obligations to himself and to others. He has had to be 'responsible.' The nature of this responsibility involves the obligations to every patient in specific situations under certain circumstances. This responsibility is based on three perceptions: a sense of justice, that is knowing right from wrong; a sense of mercy and compassion; and a sense of survival.

I feel that the most important responsibility a physician has is that of the responsibility to himself, specifically by being honest and truthful. If a physician cannot be responsible to himself he cannot possibly be responsible to others, including his patients.

Physicians have a very great obligation to their fellow man. This obligation is friendship. To those less fortunate we owe mercy and compassion (*Exodus* 22:21 - 27). We are committed to give part of ourselves, for only then does one truly give. We owe it to ourselves and to others to share what we have while we have it.

The physician's obligation to the community encompasses many aspects of responsibility. There exists for instance the very special responsibility to the older generation. The elderly must not be tossed aside and forgotten. They too had a part in making the community and they deserve to be helped without shame and humiliation. We owe them at least the honour and respect that they have worked so long a lifetime to achieve. The physician's responsibility to the community involves giving his services when they are required, to special groups and organizations. His basic obligation to the community is to help keep it a safe and healthy place to live in.

The physician's responsibility to nature is currently being challenged. We owe a great deal to nature not only because it provides us with beauty, but also because it contributes a great deal to our everyday lives. I maintain that it is the duty of today's physicians to help see to it that man does not destroy what he has left of natural beauty. This can best be achieved by providing an active voice in government and in the media to persistently remind the politicians and continue educating the public of the medical consequences involved in dealing with a nuclear "accident."

How does medical school help nurture one's sense of social responsibility? As a medical student I view my education as a privilege and not a right. Teachers have certain obligations to their students. They have the basic responsibility of teaching right from wrong. In Kahlil Gibran's book *The Prophet* he says:

> "You may give them your knowledge but not your thoughts,
> For they have their own thoughts,
> You may house their bodies but not their souls...
> You may strive to be like them,
> but seek not to make them like you,
> For life goes not backward, nor tarries with yesterday."

The teacher then is not a role-model, but rather, a by-stander who instructs and then watches his students grow. Gibran later compares this relationship to a bow and arrow. These four years of learning and growing may be considered "the bows from which" we "as living arrows are sent forth" to serve our fellow man.

Responsibility then is a fact of life which applies to every aspect of life. Without it would be like living in a lawless world. We as future physicians have a certain amount of freedom, but the price is bearing the responsibility of this freedom. There must be certain restrictions and obligations, which keep us accountable for our actions and keep us humane. This is the basic function of responsibility! It's like buying merchandise at a store. We pay for our freedoms with the responsibilities of accepting the consequences of our actions.

Physicians will always have this sense of obligation as long as the medical profession exists.□

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MEDICAL EDUCATION

Some Personal Reflections on Changes of the Undergraduate Medical Curriculum at the University of Toronto

*Robert K. Murray M.D., M.S., Ph.D.

"More than the calf yearns to suck does the cow yearn to suckle" (Arabic proverb)

". . . there is no joy in Mudville. . . . ." (E.L. Thayer)

I was initially pleased when the Editors invited me to contribute an article to this issue. Specifically, they requested that I comment on the proposed changes in the undergraduate curriculum.[1] Later, as I considered the complexity of the subject, my enthusiasm waned somewhat. However, as I reflected further, while sipping some Glenlivet, I decided that I had been presented with an opportunity to review some of the changes that have occurred in the Medical Curriculum during the 25 years that I have been associated with the University of Toronto, as well as to comment on what is now proposed.

As I am a biochemist, I shall discuss only the Basic Sciences section of the curriculum; remarks by me on the Clinical section would be presumptuous. To start with, I thought that it might be instructive to briefly review the major changes in the curriculum that I have witnessed; it may surprise some of the younger readers to discover how relatively simply curriculum matters were conducted as recently as 25 years ago.

I first came to the University of Toronto in the Fall of 1958. I had graduated in Medicine from the University of Glasgow in 1956, interned in London, Ontario and spent one year doing research in Physiology at the University of Michigan. While at Michigan, I had formed the impression that a knowledge of biochemistry might prove valuable in helping to decipher the mysteries of life, disease and death. Dr. Arthur Wynne, then Chairman of the Department of Biochemistry at U. of T., kindly informed me that I would be acceptable as a Ph.D. student under the supervision of Dr. George Connell. In return for a stipend of $1,200.00, I was also to be a Demonstrator in the Biochemistry laboratory sessions given to the 1st Year Medical Students, under the direction of Dr. Jean Manery Fisher.

This was the first occasion on which I was to be a dispenser, as opposed to a consumer, of knowledge. I was somewhat apprehensive, as I was not sure that I was up to the task at hand. However, I must say that I remember these labs, situated in the old Medical Building, with some fondness. Student morale seemed quite high, and everyone (or almost everyone) worked diligently. Various titrations were carefully performed, test-tubes were almost always boiling in water baths and chromogens of spectacular hues were developed as the chemical properties of sugars and amino acids were examined systematically.

Some of the presently most distinguished physicians in Ontario attended these lab sessions; what, if any, influence (positive or negative) the experience had on their careers is completely conjectural. More certain is the conclusion that they survived them. No one, including myself, appeared to (or was given the opportunity to) question the necessity for 130 hours of Biochemistry labs; obviously, the powers that be had decided that these labs were an integral step on the pathway to becoming a doctor.

I enjoyed being asked over to a number of the medical fraternity houses on St. George St.; I still wonder occasionally how I was able to steer my way home after some of these wild, bacchanalian nights. At that time, Dr. Wynne gave all of the lectures (about 80) in Biochemistry to the medical students. When he retired shortly thereafter, Dr. Fisher and myself shared that privilege. We both very much enjoyed our frequent contacts with the medical students.

Meanwhile, the science of Biochemistry was advancing; I remember trying to convey in a lecture to the 1st Year students some of the excitement generated in 1961 when Nirenberg and Matthei spectacularly laid the groundwork for the solution of the genetic code. At that time, Biochemistry, like the other subjects in 1st Year (e.g. Anatomy, Histology and Physiology), ran throughout the entire academic year. Examinations (both Mid-Term and Final) were entirely composed of essay questions. Typical specimens of these included, "Describe the hexose monophosphate shunt (giving formulae) and discuss its metabolic significance," and "Describe the structure and function of deoxyribonucleic acid." Some of the answers were excellent, but I should say that I seldom observed any points in them that had not been presented in the lectures. As each of the two lecturers was obliged to mark two of the four essay questions, and the class comprised approximately 160 students, some three weeks each of Dr. Fisher's and my life were taken up with marking the final exam. No formal evaluations of the course or of the teachers were performed; however, I remember receiving a bottle of Scotch and a Playboy calendar just before the X-mas break, a somewhat unstructured but mildly gratifying type of evaluation.

Despite the apparent academic serenity of the early 1960's, vast changes were in the wind. The Medical School was to expand to receive some 250 students in 1st Year, a new Medi-

cal Building was to be constructed and the curriculum — which I had naively assumed to be functioning smoothly — was to be completely overhauled. There was a feeling of excitement in the air (I compare the transfer to the new Medical Building with the entry to the Promised Land) and almost everyone appeared to be swept up in it. Only a few reactionaries muttered about the possible dangers (e.g. decline of quality and increased impersonality) of expanding enrolment. In retrospect, I think part of the excitement was due to a virus emanating from Ohio, causing what I now call Case-Western encephalitis. However, that is too simplistic an explanation; it would be of interest for some sociologically oriented medical historian to analyse the forces (personalities, principles etc.) at play at that time which resulted in a bloodless (as far as I know) but massive revolution of the curriculum. By early 1965 I was not paying too much attention to all of the fuss, as I had decided to take some Post-Doctoral training at the University of Wisconsin. I was in Madison from 1965-68, and as I was primarily engaged in research, I did not follow closely the then current trends in medical education.

When I returned to Toronto in August 1968, the transfer to the Medical Sciences Building had been completed and the curriculum itself had "all changed, changed utterly."[2] A spirit of challenge was prevalent. "Why are we doing this?" and "What is the relevance of that?" were the two questions that I remember being posed most frequently. Most of the students appeared more articulate and forceful in debating curricular issues than the faculty, myself included. Many changes were apparent:

- Systems teaching (based on the Case-Western model) was in operation
- A massive Committee (the Period I Committee) supervised the first segment of the new curriculum, with vigorous student representation
- Subjects were now taught in sharply delineated blocks of time - e.g. all of the Biochemistry Course was given in 6 weeks, in retrospect a rather unpalatable bolus
- Attendance at lab sessions (when still offered) had become more or less voluntary, with disastrous consequences on the psychology of these students who remained faithfully at their benches, but watched their more free-wheeling colleagues winging in and out of the labs at their whim
- Grades were now Honors, Pass or Fail, rather than precise marks
- Essay questions had been discarded and replaced by an intriguing new format, so-called multiple-choice questions
- Evaluations of each course and of its teachers were now routine
- An Appeals Committee to handle problems emanating from examinations and other matters had been instituted
- An Undergraduate Medical Curriculum Committee (UMCC) controlled the total curriculum, again with vigorous student representation
- The Division of Studies in Medical Education had been introduced
- The administrative sector of the Faculty was beginning to expand appreciably, to keep pace with the increasing complexity of the affairs of the Medical School, Undergraduate and Post-graduate, teaching and research.

In short, the Bastille of traditional post-Flexnerian medical education at the University of Toronto had been stormed and the practices (if not the players) of the ancient regime had been swept away. Some might argue that these were merely structural rearrangements and that little of significance, in terms of fostering such critical abilities as lifelong self-learning and problem-solving, was achieved, unlike the situation at new Medical Schools, such as McMaster. That is debatable. At the time, many faculty experienced at least transient feelings of insecurity as cherished shibboleths were questioned; however, there was also a spirit of tense excitement, as one clearly had to be on one's toes to succeed in the new ambience of challenge.

As events moved into the 1970's, the frenzy declined rapidly, a new, more stable equilibrium between faculty and students being established. The atmosphere of querulousness diminished rapidly. By the mid-1970's, dissatisfaction with the Systems approach had surfaced at U. of T. and elsewhere. It was very time-consuming, in that there were complex interrelationships among members of various Departments (e.g. Biochemistry and Anatomy) which did not participate extensively in the Systems approach causing some tensions. Also, many Departmental Chairmen did not like it, as it diminished their control over the teaching of their subjects. These and other considerations led to another revision of the curriculum in 1975, dissolving the Systems approach in the Basic Sciences, introducing some new subjects elsewhere (e.g. Addictions, Clinical Pharmacology and Therapeutics and Medical Jurisprudence) and otherwise generally fine-tuning various aspects of it.

For those readers who are not familiar with the present organization of Year 1 of the curriculum, I have summarized its structure in Table 1.

One excellent feature of the Systems approach that was lost when teaching reverted to Departmental structures was that it had encouraged frequent dialogues among members of different Departments. When Departmental teaching was resumed, intercourse among members of different Departments declined rapidly, to its present low level, except where certain faculty share common research interests. I believe that the present UMCC should attempt to encourage quite frequent meetings of faculty interested in teaching Medical Students, to discuss, for example, innovative educational methods.

Table I. — 1st Academic Year at U. of T. (1982-83, 36 wks.)

Required Courses	Lecture	Conference	Lab	Other	Total
Biochemistry,Metabolism Molecular Genetics61	16	40		117	
Gross Anatomy and 81		118		199	
Histology	18		98		116
Neuroanatomy	22		20		42
Pharmacology	25		6	13	44
Physiology	128	31	46	28	233
Science and Medicine Topic	22				22
Statistics	14				14
Medical Humanities	24				24
TOTAL	395	47	328	41	811

No substantial changes in the curriculum for Year 1 were introduced in 1983-84.

The preceeding account more or less brings matters up to the present time. During 1982-83, the UMCC, chaired by Dr. E.M. Sellers, Assistant Dean, conducted a detailed analysis of the curriculum; the Committee is to be congratulated on its herculean attempts to wrestle with the problems associated with undergraduate medical education. As part of its efforts, the UMCC appraised how the curriculum reflected its stated premises and objectives. The premises (e.g. medical education is a life-long process etc.) and objectives (e.g. to fashion a climate of learning which will develop the full potential of each student, etc.) are eloquently set out in the Calendar of the Faculty of Medicine. It would be superfluous for me to repeat them here in detail. I doubt if anyone in the Faculty does not approve of all of them. The crux of the matter is of course how to achieve the stated objectives. The UMCC identified six major problems in the curriculum (see Table 2). To correct these problems, and also because of certain other considerations, the Committee made twelve recommendations in its report; those affecting Year 1 are also presented in Table 2.

Table 2. (A) Summary of Problems with the Undergraduate Medical Curriculum[1]

1. Excessive emphasis on facts — "Fact Overload".
2. Insufficient opportunity to learn and practice problem-solving skills.
3. A curriculum orientation that does not reflect all the goals and objectives of the undergraduate curriculum.
4. Difficulties in communication, articulation, co-ordination and organization.
5. Competing financial priorities: undergraduate medical education versus postgraduate teaching versus service versus research.
6. Difficulties in effecting innovation and change.

(B) Recommendations Made in the Report that Affect Year 1 Particularly

1. That groups of selectives be presented as core educational experiences at several points in the undergraduate curriculum.
2. That the amount of curriculum time devoted to formal education be significantly reduced.
3. That the emphasis on community health in the undergraduate curriculum be significantly increased and that a coherent program in community healthe be offered that spans the four years of the undergraduate curriculum and that occupies central core, core selective and elective curriculum time.
4. That the value of the scientific method and research be emphasized in our curriculum and that Statistics no longer be taught in Year 1 and that a critical appraisal of data course be developed in its stead appropriate to the needs of students and physicians.
5. That Basic Science Departments be given the opportunity to achieve greater and more sustained impact within the curriculum in order to emphasize their fundamental and important contributions to clinical medicine and research.
6. That Elective time in each of the first three years of the curriculum be viewed and used as an integral part of undergraduate medical education.

(Certain of the other recomendations also affected Year 1 in a general manner (e.g. That a concerted effort be made to enhance the importance of undergraduate medical education within the Faculty of Medicine).

The report was subsequently presented and discussed at two meetings of the Faculty Council and Assembly in the Fall of 1983. Judging from the large attendance and the number of speakers at both meetings, there is, not surprisingly, considerable interest in the curriculum among both students and faculty. The outcome of these two meetings was approval of the following motion, which includes two ammendments:

> "That Faculty Council recommend to the UMCC that it proceed with the development of detailed proposals concerning curriculum renewal and that the UMCC bring such proposals to Faculty Council when they are ready. That the UMCC be required to develop as part of the curriculum renewal process a formal program of evaluation of the effects of the changes made in as quantitative a manner as possible. That it is understood that none of the recommendations of the Committee will be implemented before approval by Faculty Council and that a positive vote on the present motion in no way obligates Council to accept the Committee's eventual recommendations."

I believe that it is fair to summarize the tenor of the discussions at these meetings as follows. The overwhelming majority of the students who spoke approved of the direction of the report. Of the faculty, while almost all agreed with the general, philosophical aspects of the report, a very appreciable number expressed reservations about certain matters - e.g. the assertion that fact overload existed widely in the curriculum, the proposed reduction (approximately 15%) of core lecture time and the suggested introduction of Selectives throughout the first three years of the curriculum. With regard to the latter, students will be required to choose prescribed numbers of Selective courses from groups of Selectives at various points in the curriculum. The educational goals of Selectives relate to the learning of problem-solving and "issue resolution skills." Class sizes for these Selectives will be a maximum of twenty. They are to be "academically rigorous experiences." In the first semester of Year 1, Selectives will occupy one afternoon per week and will be the responsibility of the Division of Community Health. In the second semester of Year 1, it is recommended that Selectives occupy one morning per week for 16 weeks, that Selectives be of 8 weeks duration and that students be required to participate in two Selectives. The resource and financial implications involved in implementation of certain of the proposals (e.g. Selectives) were also a matter of concern to many of the faculty.

Copies of a very important report entitled "Emerging Perspectives on the General Professional Education of the Physician" were made available to all who attended the above meetings. This sixteen page document was prepared by the Association of American Medical Colleges (AAMC)[3] and was published in October 1983. It contains four sections entitled Perspectives on Learning, Perspectives on Clinical Education, Perspectives on College Preparation and Admission to Medical School and Perspectives on Faculty. The report is a compilation of views obtained from students and faculty at 82

medical schools, 24 colleges and 21 academic societies. Verbatim quotations were selected that, in the aggregate, define the problems in medical education as perceived by those who participated in the project. The emerging perspectives described in the report are intended to stimulate further exploration by individual institutions. I have summarized the Perspectives on Learning in Table 3.

It is fair to state that the report by our UMCC also selects many problems that the report of the AAMC identified - e.g. too many lectures and too much memorization of facts, not enough time for independent learning and not enough small group teaching. An area identified by the AAMC report, but not dealt with adequately by our UMCC report, is problems with evaluation (e.g. overuse of multiple-choice examination questions). The author believes that this is a major issue that has in fact helped engender much of the student dissatisfaction with our present curriculum (see below).

The next section of this article will attempt to briefly address the six problems (Table 2) that the UMCC perceived in our curriculum.

1. *Fact overload:* Both the report of the UMCC and of the AAMC stress the information (fact) overload to which medical students are now exposed. In general, while this criticism may be quite valid, and I know would be supported by a very substantial majority of our students, I have not found it to be particu laly well documented in specific terms. This aspect of the UMCC report stimulated me to perform a modest "research" project.[4] I reasoned that, as the lecture is commonly thought to be the major vehicle for the presentation of facts, it might be pertinent to compare the number of lectures presented at U. of T. with those given at other medical schools in North America The question that I asked was thus quite simple: are the Medical Students at U. of T. exposed to far more lectures than their peers elsewhere on the continent? There are 16 medical schools in Canada and 130 in the United States. The contents of their curricula are set out in the Curriculum Handbook of the AAMC. I concentrated on Year 1; however, the disposition of hours (h) in all 4 years of the great majority of Canadian and American medical schools is presented in the Handbook. As the data that I obtained (for the academic year 1982-83; little change has occurred in 1983-84) have been presented elsewhere.[4] I shall only summarize them here. Both the number of lecture h (395 at Toronto) and total class h (811 at Toronto) were below the national averages for Canada (418 h for lectures and 846 for total class h) and the U.S. (461 h for lectures and 907 for total class h), for these schools for which such data were available; a small number of schools do not give a breakdown of the number of lecture h or total class h). I draw only limited conclusions from these data (cf ref. 4). However, it is clear that 1st Year Medical Students at U. of T. do not spend any more time sitting on their posteriors passively imbibing facts dispensed by sundry lecturers than do the majority of their peers elsewhere. The possibility is there - as the AAMC report suggests - that the great majority of medical students in North America are being exposed to too many lectures. My acceptance of this possibility is seasoned somewhat by knowledge of the lecture load in Biochemistry. In 1960, approximately 80 lectures were presented to our 1st Year class, whereas in 1982-83 some 61 lectures were given; the average figure for Canadian and U.S. medical schools is 90 h I suspect that the trend has been similar in other 1st Year courses. I know that there are many Basic scientists, in other disciplines as well as in Biochemistry, who believe that the UMCC will have to produce a more precise detailing of the charge of fact overload before their statement gains wide faculty acceptance. On the other side of the coin, I do believe that considerable fact overload is generated by certain super-specialist lecturers, who deliver one or two lectures on their research areas, and then depart the scene.

I make a strong plea that individual courses should use only a few high quality lecturers, who attempt to *teach* basics and make their medical relevance clear. Perhaps some fact over-

Table 3. Some Perspectives on Learning

Problem(s)	Possible solution(s)
Memorization of facts and information (fact) overload.	Re-examine course contents with positive consideration of concepts, problem-solving and synthesis of knowledge.
Identification of concepts.	Emphasize the mastering of concepts of biology and disease, rather than the memorization of facts.
Independent learning.	Leave certain required material identified but not taught; require critical evaluation of the literature; challenge the students in small group sessions.
Reduction of lectures.	Review the volume of didactic lectures so that time might be available for independent study and/or new and necessary courses.
Small group instruction.	At least 50% of the material presented to be given in small group discussions, labs, or self-study units.
Impediments to change: large class size, information explosion and time constraints.	A courageous effort is required by faculty to overcome the emotional aspects and territorial demands of curricular planning.
Evaluation methods.	Less use of multiple-choice tests and more use of essays, papers and oral exams.
Computer technology.	Deserves greater emphasis because it provides a new dimension in skills maintenance and data acquisition.

Problems and possible solutions associated with clinical education, preparation and admission to medical school and incentives for faculty are also presented in ref. 4.

load is due to repetition of favorite subjects (e.g. hypertension) among various courses; this can be eliminated by increasing communication among the involved faculty. A major cause of the alleged fact overload is, I believe, due to the widespread use of often poorly constructed, confusing multiple-choice questions that stress minutiae. Many questions that I have seen (and submitted myself) remind one of Sherlock Holmes' statement to Dr. Watson: "How often have I said to you that when you have eliminated the impossible, whatever remains, however improbable, must be the truth." This matter is to my thinking a high priority area for reform. I do not underrate the perception of fact overload by our students. It is there, most certainly. Even more worrisome is the feeling that I have gathered from discussions with a number of students that somehow or other there is little joy associated with the learning of Basic Sciences. The AAMC report is prefaced by the following statement: "The most compelling consequence of these deliberations will be restoration of a sense of joy and enthusiasm of our medical students for the excitement, wonder and future of the biomedical sciences and human medicine. . . . " To translate this statement into a reality is perhaps the most challenging task facing our faculty.

2. *Problem-solving*: This is a major skill required by every physician. The UMCC has certainly selected an area in which our curriculum is deficient. Sessions stressing problem-solving (e.g. small group case history type seminars and exercises stressing critical analysis of data) should be an integral part of every course. The proposed Selectives may be most fruitful with regard to this concern.

3. *Curriculum orientation*: With regard to disparities between the stated objectives of the curriculum and its actual practices, the UMCC report reveals that there are few explicit opportunities for students to integrate the basic and clinical sciences. The Science and Medicine Integrating Topic has pioneered in this area. The UMCC is to be congratulated for recommending the introduction of a two week Selective designed specifically for the purpose of integrating basic and clinical sciences in the pre-clerkship period. Perhaps the subject is of sufficient importance to be required for all students! The UMCC also indicated that there is dissatisfaction with the effectiveness of Elective relative to their original expectation. It should be noted that each Wednesday in Year 1 is at present dedicated to Electives. Many Basic Scientists feel that the effectiveness of this programme should be demonstrated in the near future, and it is indeed not successful, then the time allotted to it should be re-assigned to the proposed Selectives programme.

4. *Difficulties in communication, etc.*: Until the review of the curriculum by the UMCC, there had been relatively little contact in the preceding 5 years between staff involved in teaching individual courses and the Committee. The report addresses this issue squarely and proposes a number of measures - such as increasing faculty and student participation in the UMCC and the introduction of a Faculty Undergraduate Newsletter -that should help correct this situation. I was impressed recently when reading about the concept of "networking."[5] In "networking" there is a lateral flow of information among interested parties, that does not depend on hierarchical lines of authority. This appears to the author to be a very suitable way for encouraging the exchange of views in the Faculty among staff and students with a sincere interest in medical education. For example, if the approach that a particular course is using in its teaching is met with widespread student acceptance, then I personally would appreciate hearing about it relatively quickly, so that the measures adopted might be considered for use in the Biochemistry course. Recently, more or less by chance, a number of 2nd Year students have told me that the Pathology course is now very well received. This type of information should, I believe, be accessible to all interested faculty; perhaps setting up a "networking" system (in addition to the Newsletter) would be valuable in this regard.

5. *Financial priorities*: The budget of the U. of T. Medical School is highly constrained. Increasing discussion is heard of establishing high priority areas of research to which the small number of new faculty that can be hired in the next few years will be assigned. I trust that the need for the Faculty to have first-rate teachers interested in undergraduate medical education will not be forgotten when these appointments are made.

6. *Difficulties in effecting innovation and change*: There is usually resistance to change. In some cases, this is justified, in others not. For instance, the proposed introduction of Selectives has met with some resistance among faculty. It is worthwhile to examine some possible reasons for this.

a) In general, most faculty are of a rather independent ilk (to say the least) and they usually do not welcome changes being imposed on them by individuals with whom they have often had little contact. This applies, at least partially, to the UMCC. The author, with the best of intentions, suggests that a better approach for the UMCC to employ in the future is to tell each course committee: "Here are the problems that we see with your course. What solutions can you offer?" Then, the solutions will be proposed by the faculty involved in the course and have their full support.

b) Similarly, evaluating committees often tend to adopt a blanket mentality. For instance, it is proposed by the UMCC that all courses in Year 1 undertake a 15% reduction in didactic teaching. This is understandable in terms of diplomacy, but it appears improbable to the author that all courses in Year 1 have identical degrees of fact overload; perhaps one (Biochemistry naturally springs to my mind!) or two have fact underload. A more discriminating analysis would have been helpful.

c) Another important consideration is that ideally curriculum renewal should be an ongoing, continuous process, not one periodically resulting in relatively massive upheavals, although these may sometimes be necessary. The introduction of better communication between the UMCC and teaching faculty should help alleviate this problem.

d) When substantial innovations are being contemplated, they should be accompanied by evidence that the proposed changes have been effective elsewhere, or by pilot experiments in which their efficacy is clearly demonstrated. For instance, in retrospect, the notion that Biochemistry should be taught in 6 weeks seems to defy common sense; yet that is what happened in the new curriculum of the late 1960's.

e) Another aspect of Selectives that causes faculty concern is the following. If a particular Selective is outstandingly successful and important, should it not then be available to all students? Critics would probably answer me by saying that the blossoming of certain courses could be one of the great

advantages of Selectives, and that means could be developed to allow for the situation that I envisage.

f) Finally, the fact that Selectives for 1st Year Students will be offered by both Clinical and Basic Science Departments worries some faculty. In general, the attractiveness of the hospital environment over the solely academic atmosphere of the Medical Sciences Building understandably appears to win out in most cases in the judgement of medical students. How many students will opt for Selectives in the latter milieu? I do not argue that all of the above considerations are compelling; however, taken in aggregate, they do illustrate why an apparently attractive innovation may meet with faculty resistance.

I have taken the liberty of listing some of my thoughts concerning curriculum renewal in Table 4. Many of these recommendations have been considered by the UMCC, but perhaps not with quite the same perspective.

Table 4. Recommendations by the author concerning curriculum changes.

- That faculty consider ways of generating "a sense of joy and enthusiasm in our students for the excitement, wonder, and future of the biomedical sciences and human medicine....."(ref. 4)
- That all course supervisors reppraise their courses' examination practices immediately in order to avoid testing picayune points and to stress concepts where possible.
- That all courses use only a small number of high quality lecturers whose major teaching responsibility is undergraduate medical education.
- That the return by students of course evaluations be maximized and that the UMCC be provided with yearly evidence by the course supervisor that responses to valid criticism are underway.
- That funds for summer research be sought so that each interested student can have the opportunity to work in a research environment.
- That the time allotted to small group teaching be expanded where possible and that mechanisms for increasing student-faculty interactions (educational, social) be implemented.
- That the efficancy of Electives in 1st Year be clearly demonstrated or they be replaced by Selectives, if, as seems probable, these are instituted.
- That the statement that fact overload exists widely in the curriculum be documented, preferably for individual courses.
- That curriculum revision be a constant, ongoing process and that major changes in the curriculum be preceded, where possible, by pilot experiments in order to substantiate the efficacy of the proposed changes.
- That, somewhat paradoxically, Committee structures and paperwork relating to undergraduate education be kept to a minimum or the Medical School will be submerged by their combined weight; "networking" (ref. 5) by interested faculty and students should be encouraged.

In conclusion, I should make it clear that I believe that the deliberations of the UMCC have resulted in a great deal of vigorous and healthy debate in the Faculty. This in itself is no mean achievement. Moreover, no Basic Scientist should be resistant to reasonable experimentation.

Nevertheless, when all the sound and fury subsides, the secret of successful education ultimately resides in the relationship between student and teacher that is subtly portrayed in the proverb with which I began this article. A major deficiency in the present system is stated rather explicitly in the quotation that accompanies the proverb. It is salutary to recall that mighty Casey met with more success on a subsequent occasion!□

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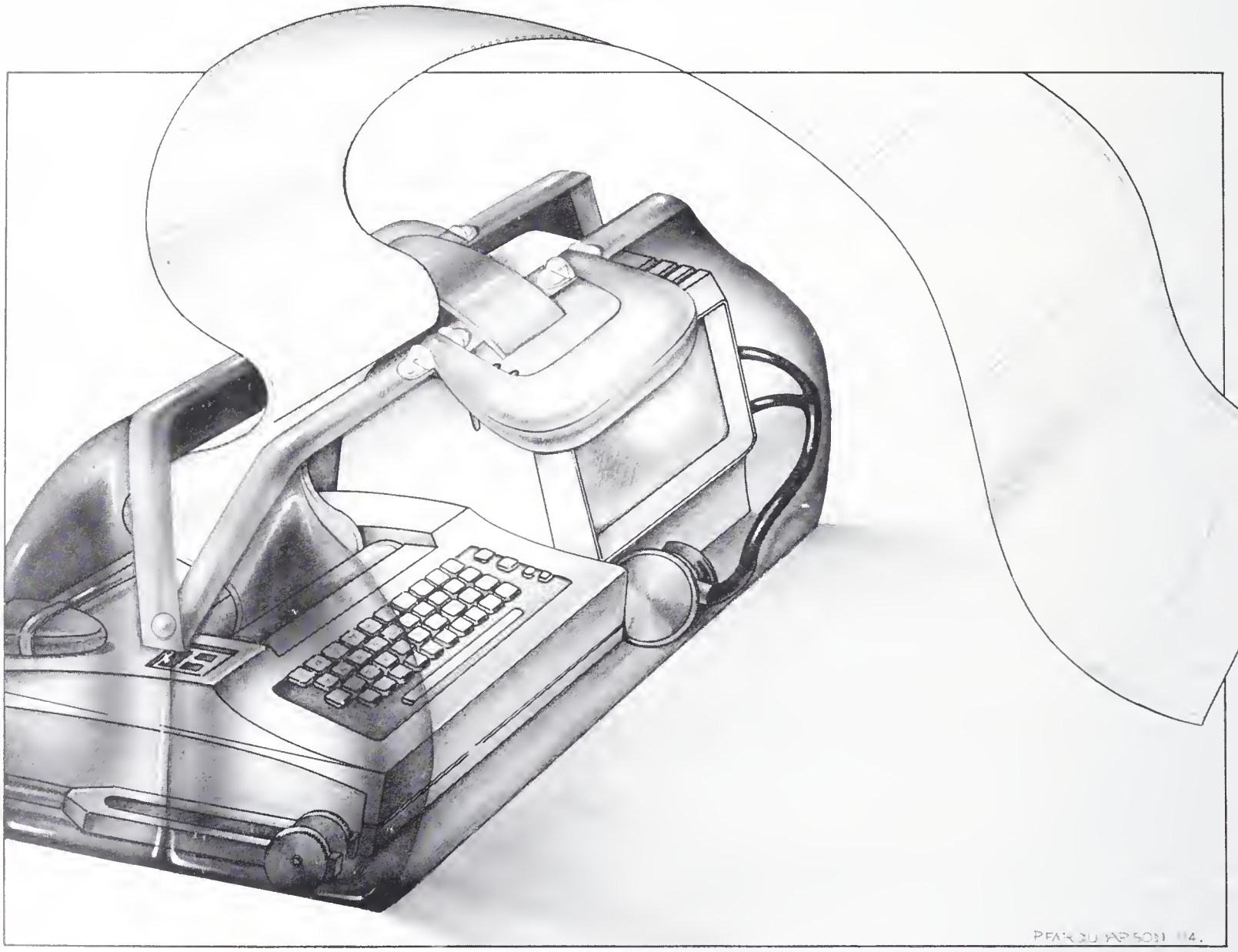
MEDICAL EDUCATION

Computers and Medical Diagnosis Part III: The Future Is Now

Paul E. Rosen* and Paul H. Marks 8T6

Computers continue to be utilized in more complex and varied applications. Significant financing and effort has been directed toward developing fifth-generation computers known as "expert systems." The process of medical diagnosis is an area in which these knowledge information systems have been developed. This paper outlines the activity in the field of A.I.M. (Artificial Intelligence in Medicine) to date, attitudes towards these new systems, their problems, and possible future roles.



Introduction:

In January 1982, the Japanese government announced that it would spend $45 million over three years to begin research on "fifth-generation" computers, a new family of machines designed especially for AI (Artificial Intelligence) applications.[1] This was then expanded into a $800 million, 10 year project by ICOT (Japan's Institute of New Generation Computer Technology), aimed at "knowledge information processing based on innovative inference functions and technologies that meet the needs anticipated in the 1990's, including intelligent interaction between man and machine and inference using knowledge bases."[2] Indeed, many American projects and firms, such as The Microelectronics and Computer Technology Corporation and The Semiconductor Research Corporation, are bringing comparable resources to bear for similar projects.[3] The Defense Advanced Research Projects Agency (DARPA) is ready to spend $1 billion on research into AI and supercomputers.[4] To date, nearly 50 of these systems have been built, with several already in use. The potential applications of this emerging technology seem almost limitless. Computers are starting to reason and to learn. By the year 2000, they will be radically altering society.[5]

At the same time, many "futuristic" advances in medical computing are just over the horizon. It is now not difficult to

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envision a future in which large data banks will hold all medical information pertaining to a selected population,[6] with smaller computers in each physician's office accessing patient records.[7] Medical schools will use computer assisted instruction for simulating case histories.[8] Medical instruments will all contain microprocessors for proper orientation and functioning.

What then of the possibility of computers performing multiple and complex diagnoses in medicine? Or is this an intriguing but impossible scenario?

At present, software exists and continues to be perfected in a field of research known as A.I.M. (Artificial Intelligence in Medicine). Scientists are applying concepts of "knowledge engineering" to develop expert medical systems aimed at performing accurate medical diagnoses, using the same logic as a physician. Systems have been developed, such as MYCIN, PUFF, CADUCEUS and others, that perform diagnoses in a variety of fields.

Many questions now arise. What are the performance figures for these expert systems? What role will they play in medical practice? How will their presence be accepted by the profession? Will it be accepted? What are the legal, social, and moral implications? To answer these and related questions, we will take a look at existing systems: their operation, their scopes, the attitude towards them, and their problems, after which we will look forward to the future roles that such systems will play and the problems that must first be solved to accomplish this.

Artificial Intelligence and Computerized Diagnosis

Artificial intelligence, broadly defined, is the hypothetical capacity of computers to work intelligently, mimicking the functioning of the human brain. When perfected, it will combine the best aspects of our abilities, e.g. reasoning, understanding, thinking, and learning, with those of the computer, such as its speed, memory for detail, and accuracy. The general goal of AI is to make the interface between computer and human as easy as possible by teaching the computer to "think" in the way humans do. John McCarthy, a scientist at Stanford University is the recognized father of AI; he coined the phrase in 1956. He feels that computers will eventually be *smarter* than humans.[9] Whether this is true or not, the question is raised whether machines can ever be truly intelligent.

Controversy rages on this subject. There is no longer any doubt that computing machines can be programmed to behave in impressively intelligent ways. At present, we have, or are currently developing, machines that prove theorems, play games with sufficient skill to beat their inventors, recognize spoken words, translate text from one language to another, speak, read, write music, and learn to improve their own performance when given training.[10] It appears that computers can learn, can reason, and can exhibit original and purposive behaviour — what can they not do? A list of the inadequacies of present-day artificial intelligence is worth noting.

Apart from the aspects dealing purely with the human/-computer interface, such as speech and visual recognition, and natural language understanding, there are several inadequacies dealing with more basic problems. The first concerns the purposive nature of computer programs. It is both an advantage and a disadvantage that the program will run on until its goal has been accomplished. People get bored; they drop one task and pick up another. Not so the computer program; it continues endlessly if allowed to do so. In some circumstances the program may be more effective than a human, but in other situations, it is very possible to waste the computer's time on trivialities and on solving problems which are of no importance. It does not act as a human would, a fact that seems to be more a matter of motivation than of intellect. Programs have goals, but they do not acquire or use them, for better or for worse, as a man does. "My idea is that there is a fundamental difference between intellect and emotion," McCarthy says. "I think that all intelligent beings will have similar *intellects*. When we program a computer to solve a certain class of problem, what it does is fundamentally similar to the way a human being solves those problems. Intellect takes the shape of the problem it has to solve. But motivation is a different matter. I regard human motivation as very eccentric and peculiar. If you were designing a machine to be intelligent and optimize the performance on some job or other, you wouldn't make the machine much like a human."[11]

Computers are more docile than men. They erase easily: an instruction or two can wipe out everything the machine has learned, whether pernicious or useful. The decision to acquire new knowledge or to destroy old memories is necessarily a deliberate one, usually taken by the programmer, though in principle the program could decide for itself. In fact, some scientists feel that no system, whether human or machine, can achieve advance intelligence unless the system can manipulate its own components, using a simple, clear model as a guide.[12] Human memory seems much less flexible than a computer's. Rarely, if ever, does a human gain complete control over what he can add to, delete from, or access in his "memory banks." As he lives, he accumulates an unlimited number of experiences of all types. The information gained from these experiences may be used to form innovative, multi-disciplinary solutions to problems. In contrast, the computer can "learn" from nowhere but its own experiences and those of its programmer, a scope that is greatly limited.[13]

Growth is a process of self-contradiction, but computer programs are never at cross-purposes with themselves. They do not get tangled up in conflicting motives, though they may oscillate between alternative courses of action. Thus, they are good at problem solving, but never solve problem B while working on A. It should be noted, however, that software is being developed to perform several tasks simultaneously. This is known as parallel processing.[14]

Taken one at a time, the differences between natural and artificial intelligence are not impressive. All together, they give rise to the suspicion that some of the cognitive activities of machines and men are still substantially different. As computers are used for increasingly "human" activities, either directly (as in simulation or diagnosis) or indirectly (as in a situation where measures of performance are psychological and social), new and difficult problems will arise. The focus of difficulty will not be in pattern recognition, learning, and memory — the intellectual aspects of intelligence. It will be in the area of motivation. Computer intelligence is "inhuman": it does not grow, has no emotional basis, and is shallowly moti-

vated. These defects do not matter in technical applications, where the criteria of successful problem solving are relatively simple, or the variables can be in some way quantified. However, the defects become extremely important if the computer is used to make sociological, psychological, or medical decisions without outside guidance from human sources.[15]

Having resolved the differences between human and computer "thought," we now turn to the field of AIM, and more specifically, to its most useful application so far, Computerized Medical Diagnosis (CMD). As it relates to medical diagnoses, artificial intelligence refers to the ability of the computer to simulate the thought processes of the physician, understanding patient symptoms and "reasoning" to arrive at an accurate diagnosis, and ideally "learning" from past cases. Why have computer diagnosis systems received such attention? "The human memory is just not big enough to deal with the modern medical knowledge base," says Dr. John D. Meyers, chairman of the University of Pittsburgh Medical Department for fifteen years, and with Harry E. Pople, Jr., developer of the most ambitious CMD project so far, CADUCEUS. "The human brain is not capable of entertaining an adequate number of simultaneous hypotheses. So the physician has to have a "crutch."[16]

There are many reasons for development of these systems, other than the oft-echoed sentiment above. Some of the benefits of such a system include:

1. Programs can produce a differential diagnostic list from the signs and symptoms presented by the patient.
2. They can indicate further diagnostic tests to differentiate the remaining diagnostic possibilities.
3. They can calculate the probabilities for various alternative diagnostic possibilities.
4. They can state more precisely and analyze the value decisions involved in treatment planning.
5. They can also compile statistics relating symptom/disease combinations and which evaluate disease, treatment, and prognosis.
6. Certain diagnostic procedures such as EKG's and EEG's can be quantitatively evaluated with great accuracy in measurement and interpretation.
7. The computer can rapidly retrieve current information about new preventative measures, diagnostic techniques, and specific treatments.
8. The computer can accumulate and recall desired aspects of a particular patient's total medical record, such as total radiation dose received, previous allergic reactions, etc.[17]
9. Less time would be required for the clinician to do searches and to do research, etc.
10. The system's operation will be uniform and consistent, i.e. "previous night's activities do not impede its functioning the morning after."
11. The variability of the clinician is eliminated.
12. Legible case records are produced.[18]
13. Screening of various types (e.g. for self-limiting or easily diagnosed diseases, for scheduling of specialists, for high risk patients, etc.) could be accomplished very inexpensively.
14. Diagnostic computer services may be extremely cost effective in medically underserviced areas, providing immediate advice for the nurse, practitioner, or general physician.
15. The diagnostic acumen of physicians may be improved upon, by using the computer to help make the diagnosis, or by increasing the certainty of the diagnosis.
16. Finally, the investigation of the problem of medical diagnosis may lead to some spinoff in unrelated areas, for instance, in the areas of decision theory, computer science and communications.[19]

Along with these benefits, three positive values emerge: a) it emphasizes the objective factors within the diagnostic process; b) it calls attention to the subjective features in the diagnosis; and c) it promotes precision of language, clarity of logic, and consistency in reasoning — values highly pertinent to the practice of medicine.[20]

After examining the reasons why computerized diagnosis holds such interest, it is pertinent to ask what methods are used to make computer diagnosis possible. A short review of the diagnostic process is in order.

To achieve a certain goal, a clinician uses his resources and the information presented to formulate a strategy. The most important influence on the choice of a particular strategy from various possible strategies is the current set of working hypotheses that represent the most plausible explanation for the patient's problems. The hypothesis, and therefore the strategy is modified according to the outcome of a so-called "tactical decision cycle" which occurs with each test or treatment which is performed on a patient. This cycle works as follows. The clinician:

a) Performs a test;
b) Observes the outcome;
c) Categorizes the outcome (e.g. positive/negative); and
d) Selects the next most appropriate test or treatment.[21]

This cycle is then repeated in the test cycle or treatment cycle until the goal is reached or until no further known strategies can be implemented to achieve that goal. See Figure 1.

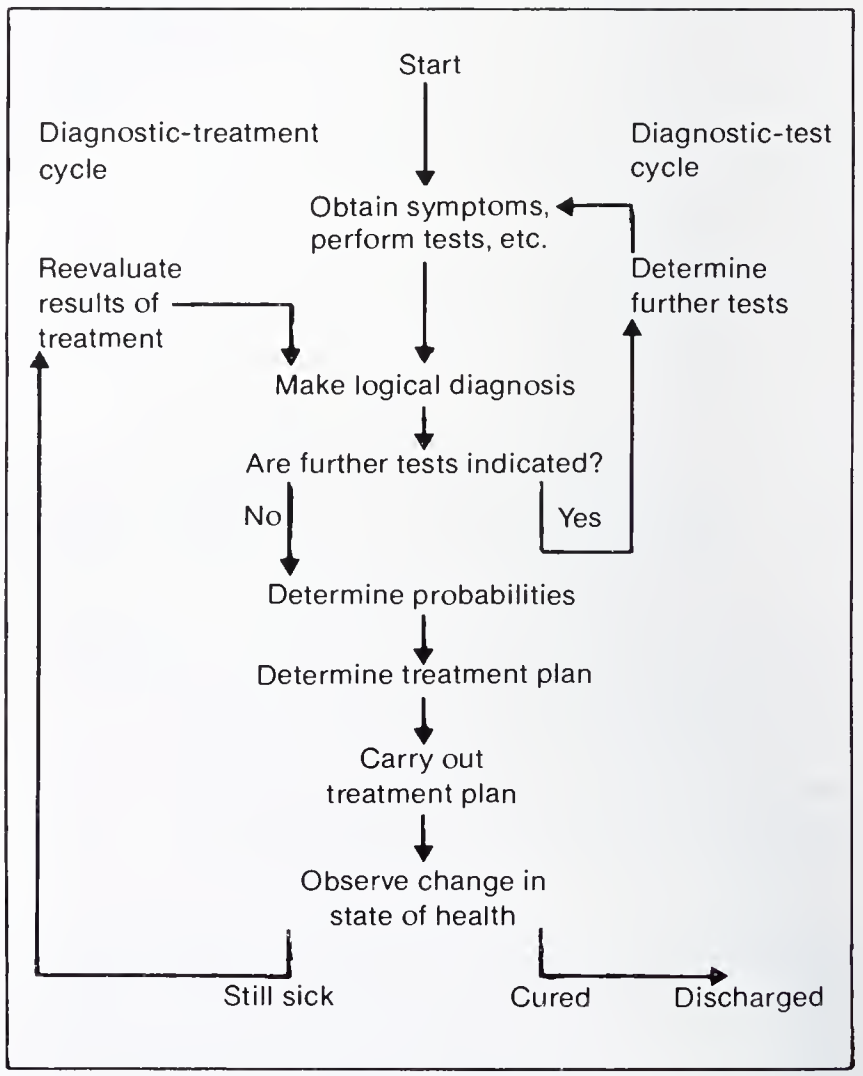

Figure 1. Flow chart for medical diagnosis and treatment[22]

The central issue in CMD is the transfer of the diagnostic procedure outlined above into a mathematical model by which to operate. It is not the function of this article to outline in detail every possible model, however, a few will be briefly discussed.

One type of model for diagnosis is the *"deterministic"* model, which uses cause and effect relationships which either define or rule out a diagnosis by a single piece of data or by logical Boolean (AND/OR/NOT) combinations of data. This is a simplistic method, and cannot be used but for a small minority of diseases.

Another model used is the *"goodness of fit"* technique which measures how closely the case descriptions fit known diseases. This technique must be used in diagnosing uncommon diseases for which probabilities are unknown. What is aimed at is the optimization of the fitting of the diagnosis to the symptoms exhibited by the patient. The mathematics of this model may be Euclidian optimization, or more recently, fuzzy set theory. The problems incurred in this system relate to the difficulty of mathematical calculations involved.[23]

The most popular model is the *"probabilistic"* type, which estimates the individual possibility of occurance of each disease under consideration on the basis of the available facts in a patient's data base. The most successful modelling of this technique has been using Bayes' theorem, named for the 18th century mathematician Thomas Bayes. The theorem is "a mathematical process that allows the probability of a certain event occurring to be calculated from knowledge of the probabilities of other events,"[24] or more specifically to our topic, the theorem allows the probability that a patient has a certain disease when he exhibits a certain symptom profile to be calculated.

Bayes' theorem, as it applies to medicine has three major drawbacks. First, detailed probability values are required for a given group of patients in a given location, that are being seen by a given physician. This problem may be overcome to a limited degree by obtaining estimates of the probabilities. Second, the theorem assumes that all pieces of data are statistically independent. In medicine this is not generally true. Most of the error observed using Bayes' rule is due to this incorrect assumption. Finally, some of the probabilities are not necessarily linked to one another in terms of the diagnosis, and are "irrelevant" to the choosing of that diagnosis. Nonetheless, these too must be in the data base.[25]

Despite these problems, Bayes' theorem forms the base of many of the major CMD systems in operation today, such as MYCIN and CADUCEUS.

What then is the method by which the mathematical models are integrated into a CMD program? There are two elements: the information presented and the decision rules that are used to interpret the information. An "expert" is used to create the knowledge base for the system and the "rules" that govern its hypothesis-building activity. More sophisticated systems allow for weighting to be attached to certain pieces of information and rules. In all cases, however, the system forms a hypothesis and selects the best test to evaluate this hypothesis. The tactical decision cycle continues until all possible diagnoses are outlined or until all symptoms have been explained, depending on the system. Ideally, the system should present the reasons for its actions at every step. In summary, a diagnostic system using artificial intelligence aims to work in the same general way that a physician would. This includes taking a broad range of observed patient data, using rules to form various hypotheses, entering a decision cycle to test the hypotheses, picking the most probable and planning a strategy for management of the patient.

Existing Systems: An Overview

After having understood the rationale behind CMD, let us now examine some of the systems that are now being used or developed. The importance of this field is evidenced by the tremendous activity concerned with creating computer diagnostic programs. A recent search of the MEDLARS II medical network produced 296 references since 1980. Clearly there is great interest in CMD. Systems are now operational in many countries, including Czecheslovakia, Russia, Japan, France, Belgium, Germany, Great Britain, China, Italy, the Netherlands, Denmark, Austria, and Mexico, in addition to the United States and Canada.

The list of clinical areas is equally as extensive. As might be expected, those fields of study that rely heavily on quantified data are more easily converted to a computerized environment. Typical of the laboratory acid/base or enzyme diagnostic systms, ELISA aids in performing enzyme immunoassays and interpreting their results.[26] Other systems create diagnoses from serum electrolyte measurement,[27] liquid chromatographs,[28] and CK and LDH isoenzyme determinations,[29] or are generalized in the treatment of acid/base disorders.[30]

Another field that often deals with quantified data and its interpretation is cardiology. Many programs have been created to interpret and performed diagnoses based on electrocardiograms. Systems, such as AZU in the Netherlands,[31] the ATREC system, which detects various cardiac arrythmias by classifying the QRS complexes,[32] the ATS system in Italy, which digitalizes, filters and analyzes three simultaneous analogical signals (ECG, PCK, and CP) with a high degree of efficiency,[33] the Bonner I program,[34] and the most famous program, CADENZA, which employs data from various non-invasive tests to predict the probability of future coronary artery disease,[35] have been found to increase the efficiency of ECG diagnosis, with a fair degree of accuracy. Other areas of cardiology are developing automated diagnostic systems dealing with digital subtraction angiography,[36] with diagnosis of coronary heart disease and myocardiopathy,[37] with analysis and interpretation of pediatric Frank vertorcardiograms,[38] and with analysis of systolic time intervals in non-compensated cardiopathies.[39]

The field of radiology also makes use of various quantifiable data sources, and is another area of great activity in CMD. There is abundance of different programs, with as diverse diagnostic functions as spinal analysis of scoliosis progression[40] and analysis of spectral patterns to classify disease involvement of carotid arteries.[41] Other uses of computers in radiological diagnoses include: the preexamination prediction of pleural fluid,[42] the diagnosis of cerebral tumours using CT scan results,[43] the urographic diagnosis of renal masses,[44] and the enhancement of fluoroscopic intravenous arteriography.[45] Two other interesting computer uses: one for a computerized nuclear probe that was used to measure ventricular ejection fraction and relative ventricular volumes,[46] and the other that uses a computer to analyze processor status to improve qual-

ity control management and data presentation.[47]

If there is one discipline that would appear to the least "computerisable", it would be psychiatry. Surprisingly, there are a number of diagnostic systems of note, and there is great activity in this field. Systems such as the French DiaSiKa,[48] the German PSE/CATEGO,[49] and the American MAC (Multidimensional Actuarial Classification), which centers on child psychopathology,[50] and PROMIS, the Problem Oriented Medical Information System,[51] which was used to evaluate a diagnosis of hyperactivity, are functioning with varying degrees of agreement with the experts. In Russia, neurotic and hypopsychotic depressions were accurately diagnosed with the aid of a computer.[52] It seems that so far, the best use of computers in this field is for purposes of categorization.

A more forseeable area of CMD research is neurology, where again, quantitative data is routinely used. The most celebrated program in this field is the NEUROLOGIST program of Catanzarite, Greenburg and Bremermann.[53,54] Currently covering over 130 diagnoses, NEUROLOGIST works by first localizing the neurologic disease and then focussing on the limited number of diagnostic possibilities, testing each one sequentially. Reported results indicate the program has a very high accuracy level. There are other CMD programs in neurology, such as the LOCALIZE program, which localizes peripheral nervous system lesions,[55] a Czecheslovakian system that makes diagnoses based on objective neurologic findings and cerebullum examination results,[56] a program which differentiates intracranial hematomas and cerebral contusions[57] a related system which predict lethal outcomes after severe head injury,[58] and a program which analyses EEGs in schizophrenics.[59]

Opthamological systems which have been developed include the Rutgers University CASNET/GLAUCOMA system, a high performance glaucoma diagnosis and therapy consultant.[60] In addition, computer reformation has been used as an aid to diagnosis of extraocular muscle disease,[61] and, at the Mayo Clinic, a system for computer-assisted perimetry for testing patients with neuro-ophthalmic diseases has been developed.[62]

There are many other systems being developed in many other fields. A partial list would include: the DDDD (Data Bank for Digestive Disorders),[63] the CONSULT system for thyroid disorders,[64] a system that analyses pulmonary function tests,[65] a classification and assessment program for diabetics,[66] a forensic science assessment program,[67] the COMIK jaundice diagnosis program,[68] a Hodgkin's disease treatment program,[69] a prognostic program for breast cancer patients,[70] a salivary gland disease assessment system,[71] an audiology program that both registers the results of and administers tests,[72] a program that will detect gastric pre-malignancy,[73] a diagnosis program for Crohn's disease,[74] MIT's PIP (Present Illness Program), which aids in history-taking of edema patients,[75] and Puff, the Stanford University/Pacific Medical Center program for diagnosis of lung problems.[76] Many of these programs are exhibiting accuracy ratings of 85-90% and above.

One area in which great activity can be observed is that of the emergency/ambulatory care field. Making use of a computer's speed and the programming by an expert, these programs allow for quicker first diagnoses and treatments, or simply aid interns and residents in taking a correct history for the complaint. One of the first such systems is the Francis de Dombal, MB, MD Leeds system for diagnosis of acute abdominal pain in England.[77] The system has been used for the past eight years in three United Kingdom hospitals, and is authorized to begin trials in 11 others. One Japanese system aims at aiding an ambulance attendant to make a correct diagnosis of a patient using data conveyed by a layman.[78] The average trial accuracy was 79.3%. CARE, which is described "a living textbook for the care of critically ill patients", was designed to help surgeons make critical care decisions, particularly in areas such as the intensive care unit.[79] The use of CARE has been attributed with reducing the mortality in trauma patients by 14.1%. HOIS (the House Office Information System) serves much the same purpose as CARE, directing the physician toward additional tests, treatment strategies, and cautions, except that it is designed for use by junior hospital medical staff.[80] Two other systems of note are the COSTAR system, now in use in over 20 centres in the United States, Finland, and Great Britain, and the Regenstrief medical record system. COSTAR schedules patients for ambulatory care, holds medical records for these patients, and issues reminders to the physician.[81] The Regenstrief system holds records and creates compact reports that remind the doctor of clinical conditions that need corrective action.[82] Both systems have been observed to increase treatment of clinical conditions.

Finally, the most exciting work is being done by general systems, i.e. those systems that can serve as models for other, more specialized programs. Many of these systems incorporate certain features aimed at correcting traditional problems in CMD. MYCIN, for example, an antibiotic prescriptive program, and its successor, ONCOCIN, an oncology consultation system, were developed by E. M. Shortliffe MD, PhD, at Stanford University to approach cases in a heuristic manner.[83] By drawing on stored data files containing attributes of diseases and other patients, and basing its decision on a series of "if-then" rules, ONCOCIN can produce a recommendation along with an explanation of its decision about five minutes after the physician starts entering data. There are many other general diagnostic systems in operation around the world, with names like RECONSIDER, SPHINX, DPS, FIRST AID, and ADM. There are general applications programs that screen patients for further examination,[84] diagnose alcoholism (the ADALGO system),[85] test US Navy submarine corpsmen while at sea,[86] and aid medical examination of first-year university students.[87] The INFERNET system, developed by D. Ludwig, MD of University of California at San Francisco, was developed to combat a major shortcoming in the systems using Bayes' theorem: that the possibility of multiple diseases and interdependent symptoms is not conveniently handled.[88] INFERNET tries to avoid these oversimplifications by applying an extension of Bayes' theorem to allow the possibility of intermediate states and interconnected diseases. One of the most difficult problems in CMD is the difficulty of the physician/computer interface. J. A. Reggia, MD, PhD of University of Maryland has designed a "Knowledge Management System" (KMS) to solve this problem.[89] A KMS does not actually contain a knowledge base like conventional CMD systems, but rather provides a framework into which a physician-author can insert his own knowledge base. Since the KMS uses a simple, "almost English" language, it allows a physician to implement a system specifically useful to him.

The Internist-1 System

Probably the most ambitious project in CMD so far is the INTERNIST-1/CADUCEUS system. The INTERNIST-1 system, and its successor, CADUCEUS, are experimental programs in computer assisted diagnosis, which were developed to act as a consultant to the physician in the field of general internal medicine. It is a leader in the field of CMD because of its generalized database, which now contains over 600 diseases, representing approximately 75% of the major diagnoses in internal medicine.

An evaluation was performed on INTERNIST-1,[90] using 19 clinicopathological conference cases selected from the NEJM cases of 1969. Forty-two cases were eligible, but only 19 cases were selected, since the data base for the program incorporated 70 to 75 per cent of the major diagnoses in internal medicine, and with an average three diagnoses per case, the chance they would all be contained in INTERNIST-1 is (0.75)x(0.75)x(0.75) or 42%.

The cases were evaluated by INTERNIST-1, clinicians at the Massachusetts General Hospital, and special case discussants. The results can be summarized as follows: out of 43 possible correct diagnoses, the respective diagnosticians made 17, 23 and 29 correct definitive diagnoses; 11, 13, and 13 total incorrect diagnoses; while failing to make a correct diagnosis 18, 15, and 8 times, for a total of 29, 28, and 21 total errors in diagnosis.

The program performed comparatively well, but the authors agree that it is still only an experimental research tool. With further refinements, INTERNIST-1 (or CADUCEUS) may become a practical clinical aid. Two problem area have been identified with this system, parallelling the two components (knowledge data base and algorithm system) of the program. While inaccuracies in the data base are easily remedied, the problems with the program itself are more severe. "Because of the ad hoc, serial nature of INTERNIST-1's formation of problem area, the program cannot synthesize a general overview in complicated multisystem problems." The program cannot reason anatomically or temporally. "What is required is a restructuring of the knowledge base to include intermediate-level pathophysiologic states and the segregation of predisposing factors from findings actually caused by a disease... Thus, the creation of a causal network of pathophysiologic states, interposed between observable manifestations and final diagnoses, would allow a diagnostic program to attribute findings to causes accurately and would help to diminish the influence of interdependent manifestations of disease." New approaches to programming complex reasoning processes in CADUCEUS are aimed at solving these problems.

Solving Existing Problems

It is clear that there are fundamental problems to overcome before CMD systems will fully graduate from research tools to functional diagnostic aids. These can be grouped into several major categories. The first is the medical knowledge base. With the huge volume of data on diseases and manifestations of those diseases, how can one system be designed or programmed to have complete knowledge on even a limited range of diseases? Jack Meyers, MD, one of the developers of INTERNIST-1 and CADUCEUS stresses that "We cannot put the system out for routine use until all those unknown diseases are fitted in — in case the patient is unlucky enough to have one of those. The next best fit isn't acceptable."[91] In addition to this, poorly defined medical terminology and the uncertainty of medical knowledge itself are important factors.[92] And this is compounded by the lack of "well-defined, reliable, complete symptomatic data about large series of patients... for most clinical problems and diseases."[93] Finally, as was noted in the analysis of the INTERNIST-1 system above, the knowledge base of a CMD system must include intermediate level disease states and linking between those states to evidence the interdependent, causal nature of those states as they occur in a living being.

A second area of difficulty would obviously be the algorithms or rule/decision structure employed by the particular program. Again, the INTERNIST-1 evaluation provided insight into a general problem: namely, that the computer has not yet been taught to think about a problem in a global manner, and can therefore not reason anatomically or temporally to comprehend complex multisystem diseases. This is viewed as the greatest problem the computer faces in becoming a reliable aid to the clinician — its inability to think like a clinician. Taylor (1980) points out that, as yet, computers do not think sequentially about the progression of a disease,[94] and M.S. Blois urges that scientists require "a means to represent common-sense knowledge in a computer program so that it can be applied to raw situations."[95] Some feel this problem will prove to be intractible,[96] but it is within the future of artificial intelligence that a solution may emerge. In fact, there are those who say that it is not important that the computer think like a physician, only that it arrive at similar conclusions and can justify those conclusions soundly.[97]

In any case, what is generally agreed upon is that a CMD system should explain its reasons for arriving at a conclusion, and that some measure of the degree of confidence to be placed in the conclusion should be calculated.[98]

There are a number of other considerations. For instance, a factor often overlooked is that the incompleteness of history-taking, or the incorrect execution or interpretation of tests will end in incorrect computer output.[99,100] Experts feel that there are technological limitations at present, such as the lack of a small, affordable computer that is able to handle a typical AI program.[101] A final problem that has been outlined is that the CMD system must according to some, be programmed in a fashion that is specific to the physician and that physician's specialty.[102] The Reggia KMS system is an attempt to answer this consideration. This opens up the larger discussion of the interface and interaction of the computer with the physician.

Attitudes Towards AIM

One of the most important factors in the growth of any new technology concerns the reaction of physicians to that technology. Computerized medical diagnosis is certainly no exception. In fact, it might be that CMD exemplifies this "trait" to a very high degree precisely because of the area it addresses: a field that is held to be the exclusive domain of *human* physicians. The reason, according to C.P. Kerr, that CMD has not grown faster in clinical use is that "physicians may not desire routinely to be reminded of the limited factors they have considered in making even the "easy" diagnoses."[103] R.B. Freidman, MD, who has been working with CMD systems for more than a decade, concurs with this view, saying

that physician acceptance has been withheld because many programs make decisions that no one needs to make. "There are very few difficult decisions in medicine. The difficult decisions are the ones that don't fit the prior mold anyway, the ones that you don't have the data to base the decisions on in the first place."[104]

Another obstacle on the road to acceptance is the false expectation of physicians, and the public in general, that computers are infallible. "The computer is not the panacea for all problems in the vast field of clinical care."[105] A survey of 146 physicians showed that computers are generally welcomed as clinical aids, but that "it is clear that physicians will reject systems that dogmatically offer advice even if it has impressive diagnostic accuracy."[10] Stresses de Dombal: "I would defend to the death the doctor's right to override what comes of the computer if he thinks it is crazy. Right across the top of all our systems it says, "Clinical judgement must take precedence; these are only suggestions."[107]

Taylor (1980) sees the physician's problems with CMD systems in much more concrete, and possibly realistic, terms. With the over-production of doctors in Canada, United States, Great Britain and Australia, the suggestion that a piece of technology replace them in their jobs is not well received. He goes on to say that the cost-effieiency of such systems must take into account the expense in disturbing established medical routines. An additional issue is that of clinical responsibility, especially in light of the growing popularity of malpractice lawsuits.[108]

Possibly the most difficult problem to overcome is what Shortliffe has called the almost "visceral" reaction to anything related to computers.[109] This attitude mirrors that of a great proportion of the non-professional population (including patients[110]) who are faced with the growing integration of computers into almost every office and business environment. It seems though, that with increasing familarity and acceptance of computers into medical offices, that this barrier is lowering. One key to this is the increasing recognition of the imperativity of acquainting prospective medical practitioners with computers.[111,112]

In the face of these negative attitudes, why are so many physicians working on development of CMD? The answer may be the future possibilities that might be realized by these very systems.

The Future: Goals and Possibilities

The central theme concerning the future of computerized medical diagnosis, is that computers will serve as aids to the clinician. It will be in various formats described as "a research tool",[113] "another piece of medical evidence,"[114] or as "a useful training device."[115] The present potential value of CMD "seems to lie primarily in its ability to remind the user of diagnoses that should be considered...to comment on the diagnostic relevance of each of the signs and symptoms; and to suggest the collection of additional data that might be of diagnostic value."[116] Will AIM progress to the point that computer programs can be formulated to think like physicians, reasoning with an overview and complete accuracy? The answer lies, as stated above, in the future of artificial intelligence technology. The physician will now, and possibly will always make the final decision regarding the patient.

What is on the horizon for computerized medical technology? Already being accomplished are systems that remotely diagnose eye-movement control and ECG's,[117] and computerized medical and scientific instruments.[118] The next big advances are predicted to be in the computer/user interface: understanding of natural (English) language[119] and recognition of speech.[120] Once this is accomplished, personal robots will become a reality.[121] The final boundary will have been crossed when the computer will be able to program itself.[122]

Conclusion

In conclusion, the computer will never nor should ever replace the physician. It will, however, serve as an important tool in the clinician's "little black bag." It will aid the physician by suggesting reasonable hypotheses or reminding him/her of other, possibly unfamiliar, infrequent, or forgotten, diagnoses. The ultimate decision must continue to be made by the physician. It is apparent that the standard base of medical knowledge is expanding rapidly and it is now impossible to learn and/or retain all information. While true "artificial intelligence" is some years off, great strides are being made in an effort to realize an accurate and efficient diagnostic aid for the clinician. Results suggest that this goal will be accomplished in the near future. For computerized diagnosis and the medical profession — THE FUTURE IS NOW!□

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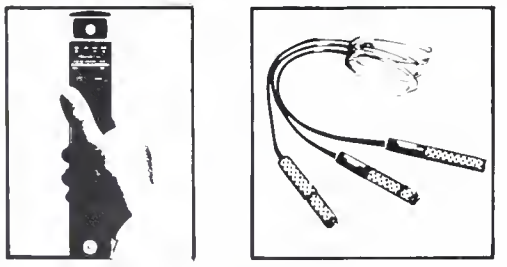

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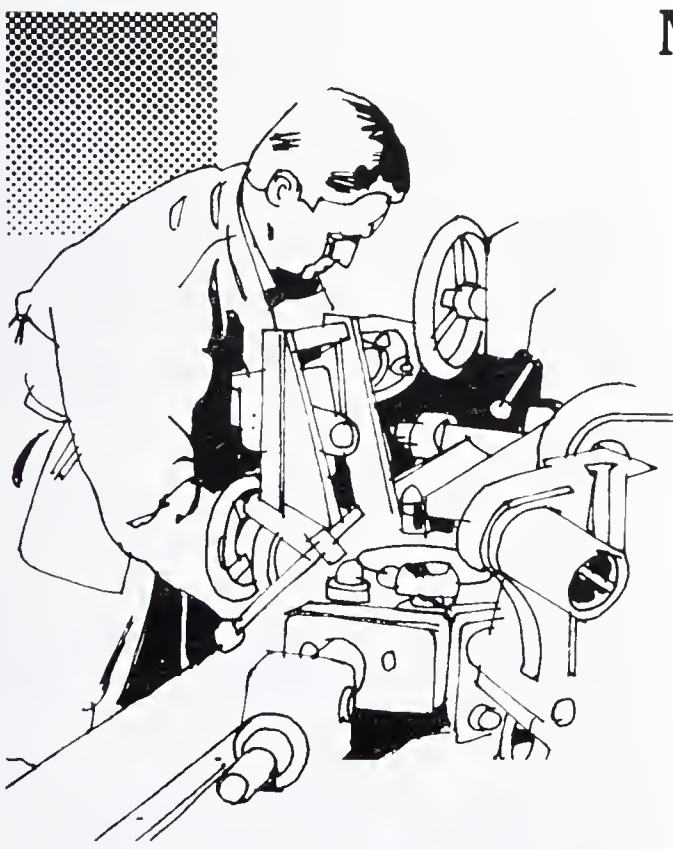

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Students enter medical school with a great deal of idealism... Some of this idealism is replaced with cynicism...'[1].

Edward M. Sellers, M.D., Ph.D.*

In early 1982, the Undergraduate Medical Curriculum Committee initiated a comprehensive review of the undergraduate curriculum. In addition, during 1983, the Faculty of Medicine was visited by a Liaison Committee on Medical Education (LCME) accreditation team. This visit came at a most opportune time since it provided input from external reviewers about the functioning of the undergraduate medical curriculum.

On the basis of these reviews, a report was prepared that was circulated to all faculty and students. This document has stimulated wide discussion about our current program. The general support for the concepts in the document has been tempered by concerns about resource allocation at a time when our resource flexibility is low. The purpose of this article is to summarize the proposals and indicate steps for the future development of the initial proposals. An article[2] last year summarized the steps and progress in Phase I or curriculum review stage of this process.

CURRICULUM PROBLEM AREAS

1. DETAILS AND INTEGRATION

> 'Teaching time is too compartmentalized with integration of knowledge and behaviours expected to occur automatically.'
>
> 'Faculties do not differentiate between the clinical knowledge that is essential for all physicians and (that) necessary for specialist education.[1]

The major problem identified by faculty, students and the LCME review team was an excess emphasis on details. This problem is reflected in our reliance on lectures, lecture notes and textbooks; and is re-inforced by a written examination system which is dominated by the use of multiple choice questions. A common belief is that this emphasis on facts contributes importantly to student stress. The Curriculum Committee feels that it is inappropriate to over-emphasize fact transfer and to evaluate students solely on their knowledge of facts. Intellectual processes such as problem-solving, self-directed learning, and skills such as continuing critical appraisal of data and information retrieval and synthesis will, in the long run, be more important to our medical graduates.

2. PROBLEM-SOLVING

The learning of problem-solving skills is necessary for the effective management of a growing and changing knowledge base by our medical graduates. In addition, such a skill relates directly to a physician's professional activities, namely, the solution of problems. At present, the first two years of the curriculum in particular are highly structured and contain few educational experiences that promote the learning of problem-solving skills. In addition, few (if any) provide an opportunity for self-initiated learning.

3. ORIENTATION

The Committee was impressed with a number of contradictions between our stated goals and objectives, and our current undergraduate curriculum[2]. Most of our teaching is conducted in tertiary care settings, hence students have relatively little opportunity to observe common problems and to see the patient as an individual within the community. In addition, there are few explicit opportunities for students to integrate the basic and clinical sciences. Despite the introduction of electives ten years ago, there continues to be dissatisfaction with their effectiveness relative to the original expectation. Many students do not seem to be taking advantage of the opportunity afforded them by this 'expanded curriculum'. The Committee felt that there was a wide range of evolving social, legal, and ethical issues of importance to physicians. Many of these issues reflect the evolving state of the health care system and therefore, should be included in the undergraduate curriculum.

4. COMMUNCATION, ORGANIZATION, ARTICULATION AND COHERENCE

Problems in these areas are the result of a large number of faculty and students; the administrative structure of the University, Faculty and teaching hospitals; the geographic dispersion of the Health Sciences Complex; and competing priorities for postgraduate education, service and research. Therefore, we require effective central communication and direction to all individuals and centres involved in the undergraduate educational enterprise if our undergraduate program is to be efficient, effective and of consistent high quality.

**Assistant Dean, Undergraduate Medical Curriculum and Departments of Pharmacology and Medicine; and Addiction Research Foundation, Clinical Institute*

5. COMPETING PRIORITIES

Present income and promotion policies reward postgraduate education, patient care and research more than involvement in undergraduate medical teaching.

6. INNOVATION AND CHANGE

Because of the problems outlined above, the curriculum is inflexible and resistant to change. Introduction of new areas of evolving importance can only be achieved by displacement of existing subjects which may continue to be important.

DIRECTIONS FOR CHANGE

1. CORE SELECTIVES

> 'Medical students (and, therefore, doctors) are usually not well educated persons in the broadest sense.'

Proposal: Groups of selectives could be presented as core educational experiences at several points in the undergraduate curriculum.

Students would be required to choose prescribed numbers of selective courses from groups of selectives at various points in the curriculum. The educational goals assigned to the selective experiences would relate to the learning of problem-solving and issue resolution skills rather than the learning of specific areas of content. Because of the importance of these skills, the selective experiences are viewed as essential for all students and are assigned core status.

The content areas involved are broadly defined as 'Society, Medicine and Health' and 'Medical and Health Sciences'. It is intended that these selectives provide academically rigorous educational experiences that are problem or issue based, experiential and directed at small groups of students (maximum 20). Formal didactic modes of instruction such as lectures are to be avoided. Assessment of students will reflect, in part, the quality and quantity of their participation, but will be derived mainly from student prepared project reports or essays. It is recommended that grades be limited to 'honours, pass or fail'.

In the first semester of Year 1, selectives could occupy one afternoon per week, and would be the responsibility of the Division of Community Health. It is anticipated that these selectives would involve community-based projects and would focus on problems and issues that are normally the domain of the Division's three departments: Behavioral Science, Health Administration, and Preventive Medicine and Biostatistics; and the Occupational and Environmental Health Unit.

In the second semester of Year 1, it is recommended that selective time occupy one-half day per week for 16 weeks. Suggested topic areas include Medical and Health Sciences (basic and clinical sciences; community health); Society, Medicine and Health (medical humanities, biomedicalethics, history of medicine, law, and liberal arts); Health in Society (the individual, the family, and the community).

At the beginning of Year 4, it is recommended that 4 weeks be assigned exclusively to two 2 week blocks of Pre-Clerkship Selectives: Basic and Clinical Science Integrating Core Selectives respectively. Students will be expected to take one selective in each of the two blocks. The Basic and Clinical Science Integrating Selective would provide an opportunity to demonstrate in the curriculum that basic sciences are vital contributors to the development and practice of medicine. It is assumed that the selectives will be either research or clinically based. It is intended that responsibility for these selectives will rest jointly basic and clinical science departments.

The benefits of including core selective experiences are as follows:

1. they provide the opportunity for student choice within broad areas of concern viewed as essential within the undergraduate curriculum. In doing selectives, students may sample from an extensive list of topics, and identify areas of interest that they may pursue in the later selective blocks or in the electives program. In essence, the selectives provide the basis for an 'expanded curriculum' which may be further expanded through the use of elective opportunities;
2. they provide faculty with the opportunity to shape the expanded curriculum, that is, to offer topics of special interest to them that are legitimate in the context of undergraduate education, but are not essential in depth for all students (e.g. geriatrics, computer applications, medical humanities, environmental and occupational health, oncology);
3. they provide the basis for increased learning related to community health, medical research and the basic sciences;
4. they provide an alternative teaching format particularly well suited to problem or issue based learning. This format encourages the learning of intellectual processes such as problem-solving that have relevance to all areas of medical education. This format also serves to diminish the current curricular emphasis on information transfer;
5. they provide an opportunity to introduce new and developing areas into the curriculum.

2. DECREASE FORMAL DIDACTIC TEACHING

Proposal: Curriculum time should be shifted to promote alternative learning formats.

This can only be accomplished if we decrease the existing lecture-based teaching program. This reduction may be justified with reference to the following: excessive emphasis on details; the need to provide alternate educational formats that can more effectively promote the learning of problem-solving skills; the need for an increase in the amount of time devoted to clinical experiences of the clerkship type, as well as the need to increase clinical exposure in the early parts of the curriculum; and the inability of formal didactic teaching to deal effectively with most issues falling within the 'Society, Medicine and Health' area, and to transmit a positive attitude towards research.

The recommended introduction of blocks of core selectives, the lengthening of the fourth year clerkship, and the introduction of a brief holiday at the end of third year will be effected through a general shortening of the courses, systems and topics of the first, second and third years (with several exceptions). In courses having a significant clinical component, it is recommended that the time reduction occur primarily at the expense of central didactic teaching.

3. HEALTH IN THE COMMUNITY

Proposal: The emphasis on health in the community within the undergraduate curriculum should be significantly increased.

This recommendation, in responding to a major finding of the 1982/83 curriculum review, acknowledges the importance of the health care system at large and the community in the contemporary view of health care, and thus its role as a major contributor to undergraduate medical education. In this context, the Curriculum Committee is using the term 'community health' to include those wide range of concerns that relate to the delivery of health care to, and impact on, an individual as part of a family, within a community and within a health care system.

4. AMBULATORY TEACHING

Proposal: The undergraduate curriculum should give increased emphasis to teaching in ambulatory settings.

To achieve this, we suggest that within the first year core selectives, experiences be developed for students in ambulatory care settings. In other portions of the curriculum, we recommend that subjects and systems take advantage of the large numbers of patients seen in physicians' offices, outpatient clinics and community health centres. We recommend that throughout third year, students have an ongoing responsibility to work under supervision in ambulatory care settings for one half-day per week. In fourth year, we recommend that ambulatory care selectives be available within the Society, Medicine and Health core selective; and that rotations be developed in Paediatrics (2 weeks) and possibly other areas such as Geriatrics, but that such additional time assigned to them must meet the constraint that they be ambulatory in nature.

5. CLERKSHIP

Proposal: The clerkship should be modestly expanded and it should assign a higher priority to ambulatory care; offer an opportunity for the development of critical appraisal skills; allow for the integration of basic and clinical sciences; and incorporate new and important developing areas in clinical medicine.

We believe that this recommendation can be most effectively achieved by the following steps: the introduction of two pre-clerkship core selectives; the consideration of increasing the time assigned to Paediatrics on the condition that this two week experience be communtiy and ambulatory based and involve student contact with a large number of infants, children and young families; the introduction within the clerkship of an Emergency Medicine rotation of two weeks duration; the consideration of the introduction of Geriatrics in the clerkship, either within the core selective block or possibly as part of the clerkship; the deletion of the existing four week selective period; and the introduction of a two week vacation period between the end of third year and the beginning of the clerkship, and the introduction of a two week vacation period at Christmas time in the clerkship.

The net effect of these changes will be to lengthen the clerkship to 52 weeks. In order to accomplish this, the third year program will have to be shortened by approximately 6 weeks.

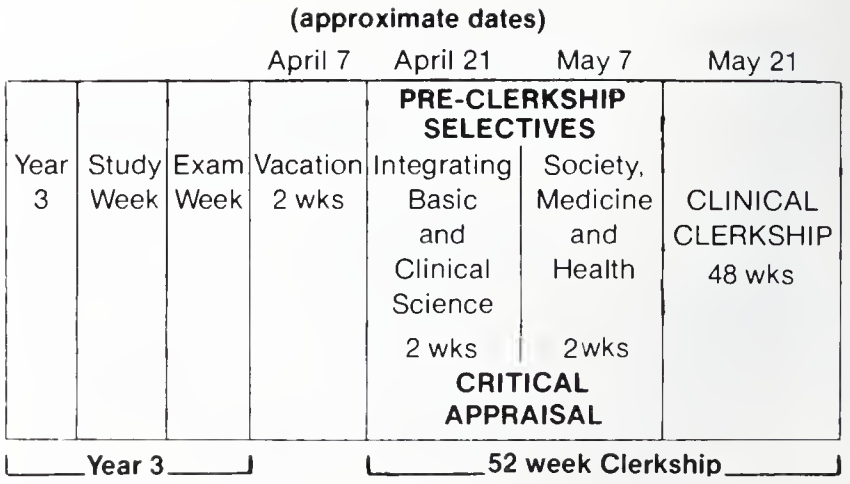

Fig. 1. Year 4-Proposed Clerkship Timetable.

6. a) CLINICAL TRAINING

Proposal: Students should have an opportunity for increased clinical experience early in the curriculum; and the amount of clinical contact for students should be increased throughout the curriculum.

We believe that this can be done if the following steps are taken: the introduction of first year selectives which include the opportunity to participate in solving real problems in medicine in the context of contact with patients/clients and other individuals; a transfer of the existing Interviewing Skills course from the first semester of second year to the second semester of first year; a reduction in the present lecture time in second year of approximately one half-day per week with the concurrent transfer of several third year clinical subjects from their existing positions in the curriculum into second year; an increase in the amount of time within the second year curriculum for the teaching of Clinical Methods.

6. b) CLINICAL METHODS

Proposal: The teaching of the important Clinical Methods and Comprehensive Clinics should be re-organized to reflect the existing departmental structure and current manpower resources

We believe that this is best done by increasing the total amount of time committed to Clinical Methods and fully integrating this course across Years 1, 2, and 3. The Departments of Medicine and Surgery, in collaboration with Family and Community Medicine, Psychiatry, the Division of Community Health, Paediatrics and other departments, would assume overall responsibility for this course.

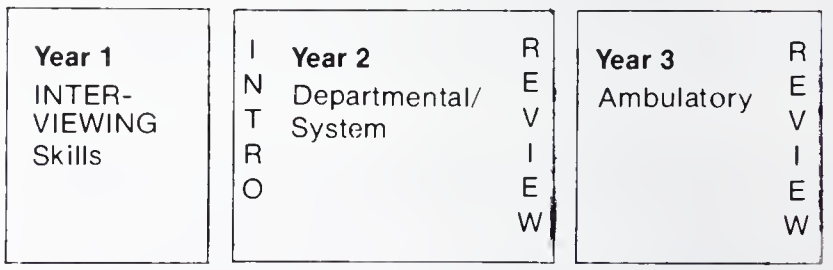

Fig. 2. Components of Clinical Methods

A committee has been formed to develop specific proposals incorporating these concepts.

7. RESEARCH AND CRITICAL APPRAISAL

Proposal: The value of the scientific method and research should be emphasized in our curriculum.

This can be achieved through the introduction of a research stream within the Years 1 and 4 selectives; the development of a more effective electives program by Basic and Clinical Science departments; the introduction of a two-week selective designed specifically for the purpose of integrating basic and clinical sciences in the pre-clerkship period; and the appointment of a Research Topic Co-ordinator for the undergraduate medical curriculum.

The Curriculum Committee feels that while biostatistics are fundamental knowledge for physicians, it is more important for physicians to evaluate critically the importance, validity and reliability of clinical observations and laboratory data. Such skills are essential elements in quality of care assessment and in developing appropriate tactics to improve quality of care (quality assurance) and to effect cost containment. A critical appraisal course should replace the current Statistics course.

8. BASIC SCIENCES

> '...learning in basic and clinical sciences should be carried out throughout the undergraduate curriculum under teachers of both categories working in collaboration.'

Proposal: Basic Science departments should be given the opportunity to achieve greater and more sustained impact within the curriculum in order to emphasize their fundamental and important contributions to clinical medicine and research.

This can be achieved by the establishment of research oriented selectives in the second semester of first year and in a two week selective (Basic and Clinical Sciences Integrating Selective). These selectives would provide in depth experiences for students to become involved in projects with the objective of integrating basic and clinical sciences under the joint supervision of basic scientists and clinicians. For example, cardiac physiology and cardiac catheterization; respiratory physiology and respiratory failure; receptor pharmacology and psychiatry, etc.

9. ELECTIVES AND THE 'EXPANDED CURRICULUM'

Proposal: Elective time in each of the first three years of the curriculum should be viewed and used as an integral and important part of undergraduate medical education.

That is, beyond current practices, elective programs should be actively promoted by course supervisors and departmental representatives; elective programs should be used as logical extensions to more formally structured curriculum events; elective programs should be used to expand the availability of clinical, community and research experiences. An ad-hoc subcommittee of the Undergraduate Medical Curriculum Committee has been formed to develop specific tactics to achieve these objectives.

OTHER PROPOSALS

The detailed curriculum renewal document also contains several important recommendations to improve communications, co-ordination and organization of the curriculum along with proposals to enhance the value of undergraduate medical education. While these proposals will not be detailed here, the importance of these recommendations is considerable. Most of these recommendations have been implemented and are starting to have an effect through broader involvement in discussing these issues.

FACULTY RESPONSE TO THE PROPOSALS

An historical perspective on the current Faculty undergraduate program is perhaps helpful. Since the mid 1960s, the Faculty functioned with a 5 - 5.5 day curriculum, a number of events have conspired to alter our expectations and capability to modify the curriculum. For example, the number of students has increased to 250 per year; the current effective curriculum time in Years 1 - 3 is only 4 days; the Faculty and University have just gone through 5 years of sustained budget cuts; increased numbers of faculty are supported on soft money often linked to research, clinical care or nonteaching activities; faculty positions have been lost and the number of new faculty positions is very limited; some departments are overstretched because of other teaching commitments. The net result of this is that internal shifts of staff or flexibility in curriculum form or content is much diminished.

Not surprisingly in the above context, concerns about manpower and resource implications have figured prominently in the response to the curriculum renewal proposals. Obviously such concerns must be met before any changes are implemented. Interestingly, criticism of the substance of the proposals has been rather linited. The existence of 'fact overload' has been questioned. The credibility and effectiveness of research selectives is unproven.

Clearly, the extent of concern about resource implications will require very careful planning and the development of new approaches.

PROGRESS TO DATE

Faculty Council has instructed the Curriculum Committee to develop more detailed proposals. To assist in this, the following planning groups and committees have been formed:

1. Selective Planning (Chair, Dr. N. Byrne)
2. Electives Review (Chair, Dr. U. Ackermann)
3. Clinical Methods Planning (Chair, Dr. J. Provan)
4. Subcommittees of UMCC
   a) Course and Program Evaluation (Chair, Dr. H. Vellend)
   b) Examinations and Student Assessment (Chair, Dr. U. Ackermann)
   c) Education Development and Innovation (Chair, Dr. M.J. Kelner)

To assist in informing Faculty about undergraduate medical education, a newsletter 'Med Ed News' will be published four times per year. Dr.Harvey Anderson and Dr. David Goldberg, in association with Karen Whalen (8T5) and Fran Turner (8T5), have agreed to serve as co-editors for the newsletter.

I anticipate that a number of proposals will be forwarded to Faculty Council from individual courses for piloting some changes in 1984/85.

References

1. Emerging Perspectives on the General Professional Education of the Physician. Association of American Medical Colleges, 1983.

2. Evolution and Renewal of the Undergraduate Medical Curriculum. E.M. Sellers. *University of Toronto Medical Journal*, vol. LX, No. 4

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NEUROSURGERY

The Ommaya Reservoir: An Implantable Drug-Delivery System

M.J. Bazos, B.Sc., 8T5, P.Y. Wang, Ph.D. and T.T. Drakos, B.Sc.

The subcutaneous reservoir and pump for sterile access to the ventricular cerebrospinal fluid (CSF) was designed and first employed by Dr. Ayub K. Ommaya in 1962 at the Branch of Surgical Neurology of the National Institute of Neurological Diseases and Blindness in Bethesda, Maryland. The Ommaya CSF Reservoir (O.R.) as the device is named by its manufacturer, was first introduced in the literature in 1963.[37]

During the past 21 years, the O.R. has been used for a variety of purposes. The original goal of most installations is usually therapy of acute or chronic CNS diseases. If necessary in the future, however, the device can simultaneously be used for both diagnosis and management of the original disease and/or subsequent complications due to reservoir complications.

Three basic models of this device are available, each of which is designed with either a 1.5 cm or a 2.5 cm base diameter. The reservoir is essentially a mushroom-shaped capsule that is designed to fit into a cranial burr-hole (Fig. 1).

In all but the two side-inlet model sizes, the capsule's base allows connection to a ventricular catheter. Both the reservoir and the catheter are made of biologically inert silicone rubber. The dome of the reservoir is specifically thickened so that repeated punctures (under 25 gauge) are self-sealing. Ommaya, in 1963, claimed that the dome can be punctured at least 200 times before leakage occurs.[37] Since no disclaimers regarding this fact have appeared in the literature, it is safe to accept his claim as accurate. Except for the 1.5 cm side-inlet, flat-bottom model, all Ommaya reservoirs are fitted with a needle-proof polypropylene shield designed for the prevention of accidental passage of the needle through the reservoir base. The principle of its operation is simple: being elastic, the dome can be compressed with a finger (Fig.2).

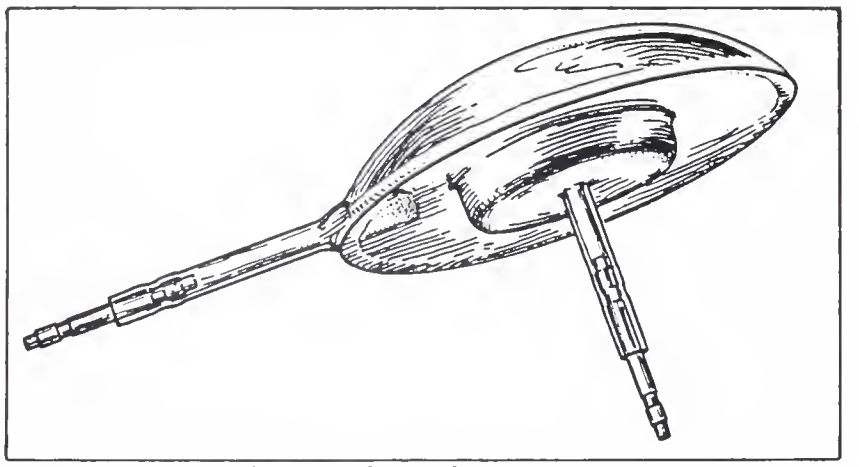

Fig. 1. Two-way adaption of capsule.[37]

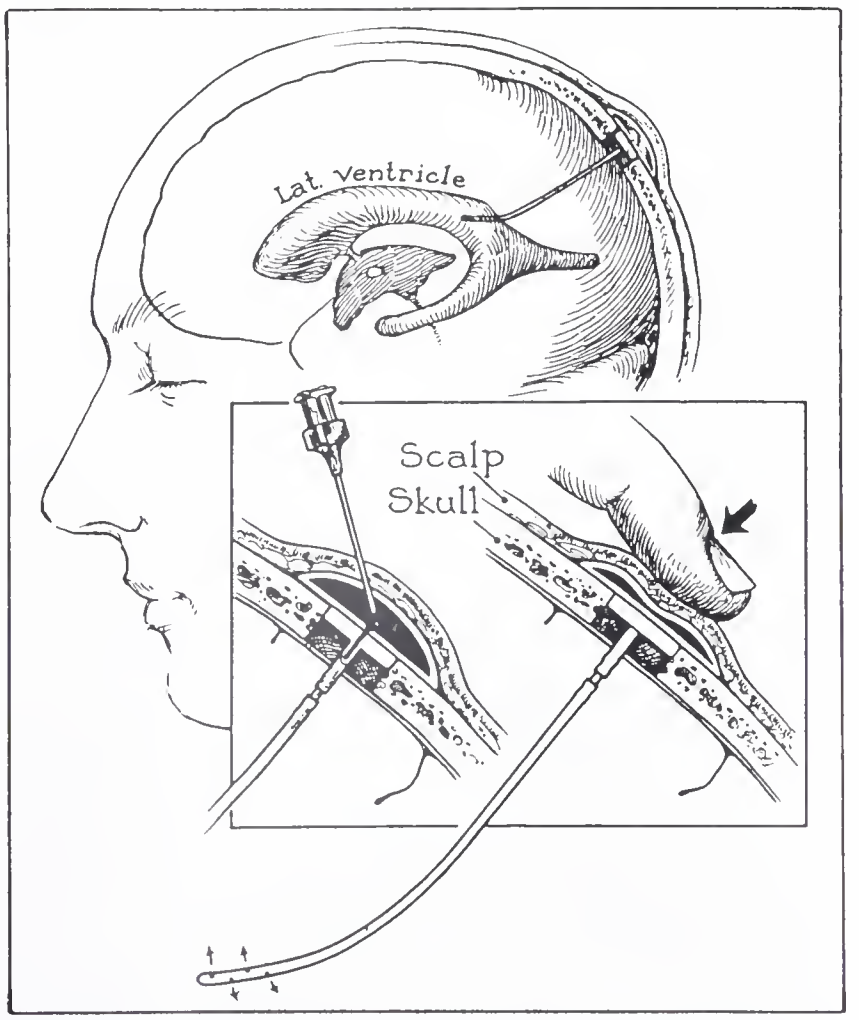

Fig. 2. Diagram of a Cerebrospinal-Fluid Reservoir connected to the Lateral ventricle, showing the Mode of Use.[42]

In this manner, the capsule is employed as a simple pump. When drainage of cerebrospinal fluid is desired, an arrangement like that in Fig. 3 will allow the withdrawal of the desired quantity of CSF or tumoral by-products by means of a syringe.

Applications of the Ommaya Reservoir

Introduced originally as an improved channel for the injection of antifungal drugs into ventricular cerebrospinal fluid, the Ommaya reservoir proved its worth in the successful treatment of cryptococcal meningitis.[37,54,51] Following this success, it proved valuable in managing several forms of neoplastic and infective intracranial lesions with an improved distribution of various cytotoxic agents,[44,42] as well as in drainage of unresectable cystic tumors of the CNS.[14] Its more recent uses include: relief of ventricular hydrocephalic pressure;[19] reliable CNS pharmacokinetic studies;[32,7] increasing the accuracy of research on CNS leukemic proliferative kinetics;[25] improving the neuroradiological applications made possible by the use of the Ommaya reservoir, and its system of catheters and connectors;[22] safe, rapid and continuous cytologic monitoring of cerebrospinal fluid;[33] increasing our

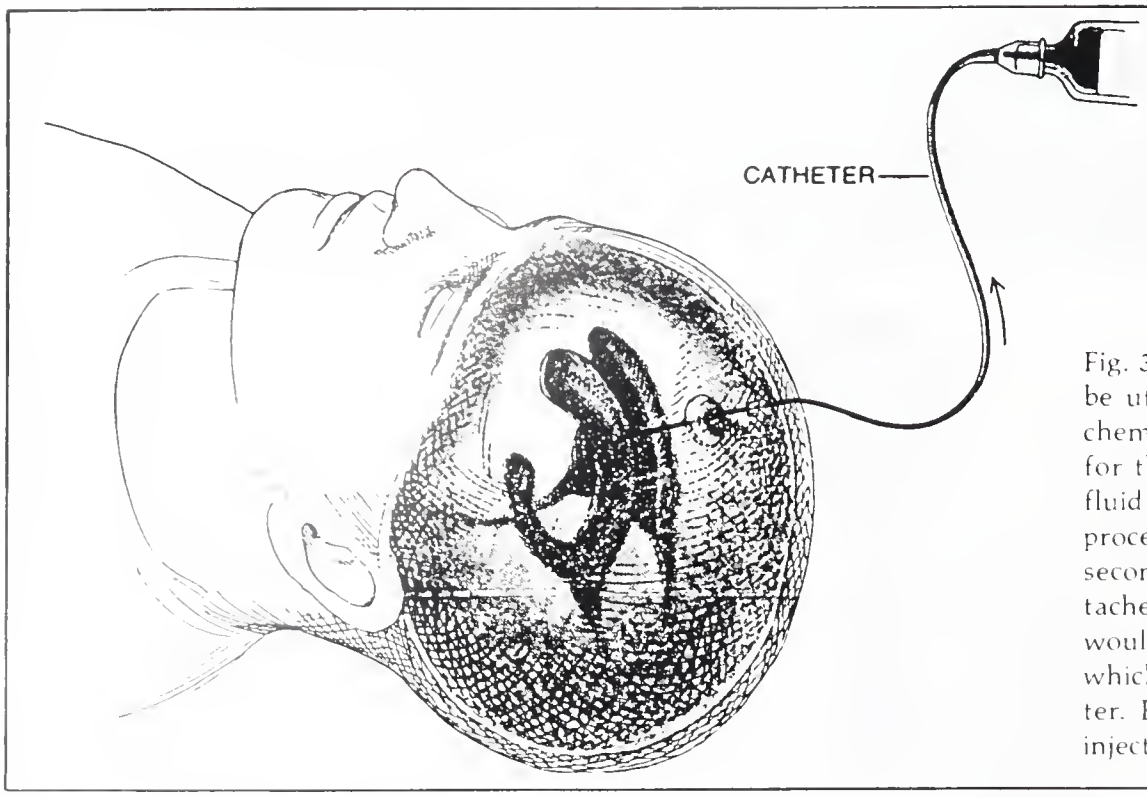

Fig. 3. Ommaya Reservoir is depicted as it would be utilized for the delivery of a drug such as a chemotherapeutic agent (*top*) and as it would serve for the withdrawal of quantity of cerebrospinal fluid by means of a syringe (*bottom*). In a typical procedure the syringe would be put aside and a second syringe containing a drug would be attached to the cathether. More cerebrospinal fluid would be withdrawn to be mixed with the drug, which would then be injected through the catheter. Finally, fluid in the first syringe would be injected to flush the system.[3]

knowledge regarding several of the many CSF physiological variables hitherto inaccessible to researchers;[55] the first foolproof method by which virtually continuous monitoring of thoracic effluent (in cats) was feasible;[26] the creation of several model systems on carcinogenesis in bladders based on work performed with Ommaya reservoirs[38,24,23] and very importantly, in developing prophylactic strategy for CNS disease.[47,48,50] (See Tables 1 and 2)

No bedside techniques of differentiating punctures of the subdural sac from that of the subarachnoid space exist[41]; consequently, intrathecal lumbar injections fail at a fairly high rate of about 10%, with the drug to be placed in the CSF distributed in the subdural or epidural spaces.[28] As a result, some have recommended the cisternae magnae as a better site than the lumbar sac for intrathecal injection.[53] In addition, there exists the potential problem of cerebral herniation if there is an increase in the intracranial pressure of patients whose intrathecal space was penetrated from below, as would be the case for cisternal injection. In addressing this danger, several surgeons have pointed out the most reliable site of intrathecal drug-injection: the intraventricular route achieved with the use of the Ommaya reservoir.[45] Other researchers, in addition, have indicated regarding lumbar injections in monkeys, that only when the drug constituted 25% of the CSF did some thorough distribution occur throughout the cerebral subarachnoid space and ventricles.[43] Since such high doses are not normally recommended, the direct access to the CSF provided by the Ommaya reservoir is of added benefit to the patient by the reduction of high dose-related toxicity.[45] In addition, the duration of the median remission during CNS lymphocytic leukemia has been prolonged with intraventricular (Ommaya reservoir injection) rather than intra—lumbar-injected methotrexate therapy.[6,13]

TABLE 1. Types of Disease and Numbers of Patients in Whom Reservoirs Were Installed.[42]

TYPE OF DISEASE	NO. OF PATIENTS
Craniopharyngioma	5
Intracerebral hematoma (thalamic hemmorrhage)	1
Resistant meningeal leukemia	5
Cystic tumors other than craniopharyngioma	3
Glioblastoma multiforme	18
Benign intraventricular tumor (? hematoma)	1
Fungous meningitis	13
Sarcoma of brain	1
Toxoplasmosis*	1
Head injury	6
Hodgkin's disease and lymphoma	2
Hydrocephalus	5
Total	60

*This patient also treated for Hodgkin's disease & therefore shown twice.

TABLE 2. Uses of the Reservoir.

USES	NO. OF PATIENTS
Chemotherapy:	
Perfusion with methotrexate or 8-azaguanine	12
Amphotericin B	10
Primethamine	1
Methotrexate instillation	4
Aminopterin instillation	3
Experimental chemotherapy	5
Cystic tumor drainage:	8
Diagnostic studies:	
Iophendylate	1
Intracystic air study	3
Indigo carmine study	4
Ventriculogram	14
Isotope studies	13
Ventricular drainage:	14
Antibiotic therapy	4
Cerebrospinal-fluid analysis	39
Cerebrospinal-fluid studies	14
Intravenous therapy	1

Finally, the most important point to be stressed is the relatively simple surgery for reservoir placement in the skull; subsequent punctures of the rubber dome are painless and are well tolerated by the patient, especially in cases where repeated lumbar injections have resulted in arachnoiditic tissue surrounding this irritative focus.

Use of the Ommaya reservoir is, however, accompanied by some unfortunate risks. Some surgeons have reported in their *Amphotericin B* therapy for fungal meningitis, a high rate of infection and malfunction (12 of 15 cases),[11] while another has pointed out that improvements in surgical technique could improve its safety.[41] Others, furthermore, have reported problems such as misplacement of the catheter which led to tissue necrosis or epileptic seizures.[48,45]

A Procedure of Surgical Implantation of the Ommaya Reservoir on a Human Skull

Ommaya's description of reservoir placement on the right parietal region has, more recently (ca. 1970), been challenged; current preference is towards a frontal placement.[15,29] In the application of local chemotherapy for solid tumours of the CNS (eg. glioblastomas), however, the closest site to the tumor is the wisest choice for reservoir implantation.[29] Surgical procedure and successful installation of an Ommaya reservoir, as expected, varies with the surgeon and his experience.[16,29,30]

Surprisingly, little technical data on Ommaya reservoir surgery aimed at non-surgeons is available in the literature.[37,29,30] One of the exceptions is the thorough and well-illustrated technical note by Leavens and Aldama-Luebert.[29] The procedure they present in this paper will certainly be useful to oncologists whose future preference towards intraventricular therapy of CNS pathology will necessitate Ommaya reservoir deployment. Following the brief section on surgical prophylaxis and bone microbial infection, the technique described below is based, largely, on this useful report.

Suggested Antibiotic Prophylaxis Prior to Ommaya Reservoir Surgery

In a review of 17 authors, it has been calculated that the complication frequency following the installation of ventriculoatrial shunts includes an average infection rate of 13.5%, with a range between 7% and 29%.[31] A variety of treatments have been proposed by these surgeons; more recently, however, increasing emphasis is being placed on the use of prophylactic antibiotics.[52,2,8,46,50] In an attempt to minimize the rate of such infections, Trump and his associates have very recently devised a successful regimen of antibiotic prophylax is 50: 2 g of nafcillin is injected intravenously before the preparation of the skin prior to surgery; following surgery, 1 g per four hours is applied (I.V.) for the next 24 hours. Patients allergic to penicillin may, instead, receive 1 g vancomycin intravenously in the operating room and 500 mg, 4 times over the next day. This schedule is intended to provide high systemic antibiotic concentrations during the operation while employing a drug to which *Staphylococcus epidermidis* is sensitive in quantities sufficient to produce an effective level in the CSF.

Surgical Description of Ommaya Reservoir Insertion

The patient, anesthetized endotrachealy, is placed in the supine position with his unrotated head tilted 5 degrees forward. The prevention of microbial entry during the procedure will be extended by scrupulous atraumatic aseptic technique,[29] while the risk of skin infection can be minimized by the use of a depilatory (a hair removing agent).[17] A 4 cm inverted-U incision is made in the right frontal region with its centre over the coronal suture with its medial limb in the midline.[29]

Excision of pericranium equal in diameter to that of the Ommaya Reservoir is followed by burring a hole centered 3 cm laterally to the midline. The dura matter is cut in a cruciate pattern until the underlying frontal cortex and its blood vessels are visible. A pial cortical incision is then made in a location which best avoids these blood vessels (when necessary, bipolar coagulation of the vessels should be induced). Next, an 18 gauge cone needle is guided 1 or 2 degrees in the plane between the burr hole and the point 2 cm anterior horn of the ventricle. Use of the cone needle, however, has been criticized as being superfluous and hazardous, particularly due to repeated passes through the brain matter.[29] If, during reservoir insertion computer tomography analysis is employed, up to 200 ml of sterile air may be injected into the ventricles (in some cases, however, due to adhesive arachnoiditis resulting from repeated lumbar punctures, lumbar subarachnoid air injections may not be possible).[54]

After soaking in a methicillin sodium solution, the reservoir and catheter are attached. If the distance between the catheter tip and the reservoir base is kept at 7.25 cm, in most adults the catheter tip will be proximal to the ventricular floor allowing the catheter's holes full contact with cerebrospinal fluid.

In an effort to address the difficulties encountered during intermittent drainage of intracranial cysts, it is advisable to remove, by cutting off, the perforated end of the catheter because the viscosity of the future cystic fluid may interfere with the ability of the Ommaya Reservoir apparatus to aspirate. After the reservoir and catheter are rinsed and filled with saline solution, one side of the catheter's tip wall is cut between two side perforations. Through this slit, a blunted 15 cm, 18 gauge spinal needle stylette is passed so that all three pieces are held by this arrangement, mostly on the outside of the catheter. After the cone needle is removed, the same path is traced by the catheter until its tip passes through the ventricular roof; now, the stylette is withdrawn while the catheter is advanced to the point that the reservoir meets the calvarium. In order to ensure the proper positioning of the catheter tip, a lateral cranial x-ray is taken. Under ideal conditions, the catheter will only have reached the ventricular floor near the foramen of Monro (this single x-ray is normally sufficient). If its position is unsatisfactory, however, it may be reintroduced after adjustments are made to the catheter. The pericranium initially excised is then used to cover the burr-hole over the dura before suturing the pericranium on the outside of the calvarium.

Two days following the operation the reservoir can be employed. Again, before use, surgical sterile technique is applied to the scalp. Any butterfly infusion set smaller than 23 gauge can be used for oblique puncture whereas the manufacturer suggests anything under 25 gauge. By elevating the butterfly tubing, intraventricular pressure can be measured; lowering it provides the surgeon with a ventricular CSF sample. At any time after this, chemotherapy may proceed. To

obtain good catheter placement in some patients, however, is very difficult. Since the procedure inherently carries risks of hemorrhage and unsatisfactory placement, the importance of improved methods of guidance and visualization are apparent.[5,42,48]

Towards these ends, the benefits of using Computer Tomography (CT) are being evaluated.[20,39,30] Although the use of the CT scanners is limited by their prohibitive costs and size, they have proven their worth in Ommaya reservoir surgery, particularly in patients whose ventricles were almost slits and proved to be impossible to penetrate without accurate guidance. Based, in large part, on Levy's and Hahn's Technical Note[30] on *Ommaya Reservoir Insertion Guided by Computer Tomography*, a description of the modifications of Leavens' and Aldama-Luebert's method follows: (The body scanner in which the operation was conducted was a Technicare Delta 2020). Scanning preoperatively the marked burr hole site, the same surgical protocol observed in a sterile operating room is followed. In the scanner, initially, the patient is moved 40 cm through the beam in order that better access to him is available. Conventional draping is employed, followed by the creation of surgical access to the cortex as previously described.[29] The U-shaped skin is retracted on the edges using plastic Raney clips. The ventricular catheter is moved towards the lateral ventricle in a direction determined by the initial preoperative scan. After a 2 cm advance, plastic bulldog clamps hold it in place. The surgical area is now covered with towel drapes and the patient is pushed ahead about 40 cm into the scanner beam allowing for an image of the catheter's location (Fig. 4).

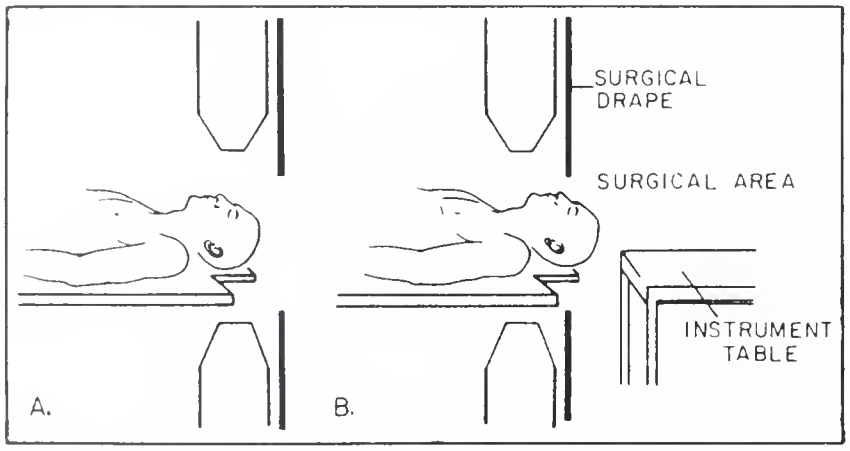

Fig. 4. (A) patient in the CT scanner positioned in the scan beam. (B), patient advanced through the scanner into the surgical field.[30]

He is then moved to the sterile field once again, the towels removed, and the catheter is manipulated in accordance to its postion during the last scan. After CSF contacts the catheter's tip, if possible, the catheter is advanced until it rests anteriorly to the foramen of Monro. If the ventricular anatomy prevents this, or if the anterior horn is too narrow, another scan is made. At this point of time, the reservoir should be buried in the subgaleal pocket.

Necessary adjustments are performed and a final scan is taken to verify the catheter's final position. In addition, possible hemorrhaging can thus be detected. After successful implantation, the skin is retracted, followed by antibiotic prophylaxis.

Duration of Patient Contact with an Ommaya Reservoir during Clinical use of the Device

Due to its biologically inert materials (*i.e.* silicone elastomers), the Ommaya reservoir has proven to be a device, which, barring complications due to human error (such as *S. epidermidis* infections), can remain in the same subcutaneous site for several years. If complications arise before therapy is terminated due to amelioration of the condition, the device must either be removed immediately or the therapy must be modified to reverse some of the complicating sequelae.

One physical factor which determines the reservoir's durability is the elastomer dome which may leak after 200-250 needle punctures. Since the inventor of the device recommends any needle device smaller than 25 gauge,[37] it would appear logical that a much wider needle bore would not allow the silicone rubber to self-seal as well as it does following smaller punctures. Similarly, the puncture pattern, over time, must be of an average distribution so that no one area of the dome will be more prone to leakage, and consequently, to invasion by infective agents. It appears from the literature, then, that given a limit of about 250 needle punctures on the reservoir dome, and assuming there are no infective or metastasis-related complications (or death), the Ommaya reservoir can be successfully retained by the patient for at least 5 years after implantation, depending on the case-history of each patient's therapy.

As early as 1968, in a preliminary report on Ommaya reservoir use in 60 patients, specific trends indicated that most complications occured within the first three months from implantation.[42] The policy of these two surgeons has been one of early removal of the reservoir after remission or amelioration of the tumoral or infected CNS tissue. In this report, 1 of every 8 implanted reservoirs remained in use for three or more years. Another report cites the successful use of an Ommaya reservoir for drainage of a cystic intracranial lesion for at least 44 months. During intraventricular therapy of CNS leukemia, in one case, a single Ommaya reservoir has been continuously employed for at least 4 years, despite complications related to staphylococcal infection.[6]

The other variables affecting the device's durability are, in one way or another, all related to some complicating factor caused by the pathological condition or by human error (e.g. misplacement of the ventricular cannula or of unecessary infections). In cases of intraventricular cyst drainage using an Ommaya reservoir, for example, one of the most common difficulties encountered is the high degree of viscocity of the aspirate to be withdrawn as well as obstruction by cystic byproducts. With no other choice available, catheter and reservoir are withdrawn for catheter replacement. Another solution available to the surgeon is the cutting of the perforated catheter's tip, preoperatively, so that no blockage will occur in the catheter.[14] Consequently, this simple step will potentially extend the reservoir's clinical use with little effort or change of surgical protocol.

Accidental detachment of the catheter from the reservoir, on the other hand, will necessitate reservoir removal, and greatly reduce the device's durability, as well as resulting in severe complications. Specifically, displacement of the catheter's tip will often induce expected complications such as large-scale necrosis of cerebral tissue, that possible benefits from future reservoir treatment would be rendered useless.

Reservoir durability in some cases, however, can be extended; whereas one surgeon recommends immediate reservoir removal after infection by S. epidermidis,[11] others

prescribe intraventricular vancomycin treatment without removal of the infected reservoir.[49] Barring uncontrollable pathological developments, it seems logical to expect that with greater surgical expertise and innovation in reservoir implantation, the clinical lifespan of the Ommaya can only increase.

Uses of the Ommaya Reservoir System

(i) Intraventricular Chemotherapy for the Central Nervous System Using the Ommaya Reservoir

In meningeal diseases, systemic therapy would be a simpler proposition if the chemotherapeutic agent were free to pass through the blood brain barrier. Sufficient concentrations of the drug could thus be maintained by intravenous adminstration, allowing, in this manner, continuous bathing of the cranial interstitium.[1] During the disease, however, the barrier is sufficiently altered such that some drugs can gain better access to the affected tissues. Such drugs include streptomycin and penicillin.[10] Metastasis of leukemic cells, however, does not provide certain cytotoxic drugs increased access to the affected meninges.

Intrathecal installation of the drugs into the CSF is thus the only possible therapy.[36] Unlike lipid-soluble compounds that can readily pass from blood to the CSF and, in turn, through capillary walls, there is evidence to indicate that the mode of transport of lipid-insoluble drugs from CSF to the brain is diffusion.[44] Given any distance, the distance the drug will diffuse can be obtained from the following equation:

$$C = (C_0) \times (\text{erfc}) \times (X/2 \sqrt{Dt})$$

(Eqn.1).

Where C = concentration of the drug at a distance = cm from the perfused surface, at time t (seconds). D = the diffusion coefficient (cm^3/second), C_0 = the drug concentration in contact with the brain tissue while erfc i = the correction error function of the equation.[44]

Thus, given a specific duration of time, the concentration of the diffused drug in the tumor can be estimated; similarly, the distance between tumor and ventricular surface can be measured through X-rays and the time of perfusion for a given concentration can be calculated. Drugs that move by diffusion enter the brain at a rate independent of intraventricular pressure.[44] At high diffusion rates, the concentration of drug over the ventricular surface approaches the inflow concentrations. This can be observed from Heisey's equation:

$$I/O = (P/V) + 1$$

(Eqn. 2).

Where I = inflow concentration from the Ommaya reservoir in mg/ml, O = outflow concentration from the reservoir in mg/ml, P = CSF production rate in ml/minute and V = inflow rate of CSF in ml/minute.[44]

Evidently, as the ratio I/O approaches unity, the average concentration of the drug in the ventricles approaches the inflow concentraion (this is finally achieved when the rate P has fallen very dramatically, relative to rate V). After the perfusion has ended, the concentration of the drug declines in the CSF as new fluid is produced.

Rubin et al[44] report unpublished research which has demonstrated that an antineoplastic agent like methotrexate (MTX) diffuses into the brain tissue like inulin, and that it is maintained in therapeutic quantities for up to 12 hours following a 4 hour perfusion. Similar conclusions can be drawn from the work of other researchers.[45]

Early research to determine optimal doses and the most effective regimen for cytotoxic agents such as MTX yielded little more than a confirmation that complications due to MTX neurotoxicity is some cases were almost equal to the benefits accrued by other patients who were fortunate enough to have undertaken a more successful chemotherapy.[40] Recent work has produced many useful findings regarding the usefulness of the Ommaya reservoir in perfusion therapy. Bleyer, for example, has analyzed the effectiveness of MTX in concentrations that varied by a factor of 100; his correlation of CSF-MTX concentration age, weight or Body Surface Area (BSA) yielded an unexpected relationship.[4] The least amount of drug concentration variability between different patients (in the parenchymal brain after perfusion) occurred when a conventional-dose schedule of 12 mg/m^2 was replaced by a constant dose of 12 mg regardless of age or BSA. Some authors appear to have, since, adopted this approach.[12]

To a large extent, intraventricular chemotherapeutic perfusion is effective against the spread of leukemia, lymphoma and some solid tumors in the leptomeninges.[5,18,23] In the treatment of CSF disseminated tumors, however, its effectiveness is rather limited. To date, little research has been conducted in this area of oncology. At the present, only temporary stabilizations are possible for dissemination of medulloblastomas in the CSF.[21,12]

The effectiveness of the Ommaya reservoir in CNS neoplasia using MTX therapy is fairly significant in cases of acute lymphoblastic leukemia and acute myeloblastic leukemia. Presently, it can only provide palliative treatment for lymphoid blast crisis of chronic granulocytic leukemia.[27] Comparisons of the length of CNS-leukemia remission between lumbar-injected patients and Ommaya-injected patients have indicated that the rate of CNS relapses fell from 2.94 relapses per 1000 days to 0.93 relapses per 1000 days using intraventricular treatment.[6]

The probability for bacterial contamination of the CSF without evidence of clinical infection is about 8% and ranges between 7 and 50% for bacterial meningitis.[42,11] The most common organisms responsible are Staphylococcus epidermidis and Corynbacterium species.[11,42] In cases where perfusion must be performed using the Ommaya reservoir for microbial infections of the meninges or the CSF, the use of the direct ventricular route rather than the lumbar or cisternal routes have been encouraged.[54] This intrathecal injection of Amphotericin B is a valuable means of controlling infection of the meninges due to coccidioides species[53] and crytococcus neoformans.[9,54]

Several successful treatments have been presented in the literature: Sutherland and his associates treated S. epidermidis infection of a reservoir with vancomycin without reservoir removal.[49] Similarly, other researchers have reported the successful treatment of four patients via the ventricular route for Staphylococcus bacteria as well as some species of Pseudomonas[50].

(ii) Management of Unresectable Cystic Pharyngiomas of the Brain Using the Ommaya Reservoir for Aspiration Purposes

If possible, total extrication of histiocytic lymphomas is always the most sought-after solution to this problem.[34] Before Fox's 1967 Technical Note[14] on drainage of these intracranial cysts, needle punctures, shunts or recurrent surgical drainage were the only choices for decompression of these cavities. In the note, he paid particular emphasis on the correct procedure for placing the cather in the area near the cyst so that the viscosity of the fluid would not result in the cannula's obstruction. In the event that total excision is deemed impossible or unsafe, the intermittent aspiration of the liquid produced by the cyst can be performed using Ommaya-style apparatus.[18] The relief from high intracranial pressure then, would make the procedure worthwhile —even though the probability is that relief, each time, is only temporary.

(iii) Ventricular Drainage

Often accompanying fungal meningitis is the development of hydrocephalus. Similarly, increased intracranial pressure may develop as one of the sequelae of a sudden change in an intracranial tumor. Immunological reactions to heavy chemotherapy can also cause cerebral edema — a condition that can temporarily be relieved by ventricular drainage. A pediatric scalp-vein needle with its attachments are made to puncture the subcutaneously implanted reservoir and the drainage soon follows. This event may be repeated until the complicating factor that caused the hydrocephalus is corrected.

(iv) Cytological Studies of CSF and Fluid Analysis via the Ommaya Reservoir

This area of neurosurgery can potentially allow so many variables to be quantified that the advantages provided by the Ommaya reservoir are significantly increased. One of the most obvious uses of the device is to provide rapid access to the CSF for assessment of the dynamic characteristics of this CNS supportive medium. Some surgeons have used the reservoir for regular cytologic analysis of the CSF to accurately gauge any exacerbations of the conditions and to determine the effectiveness of the therapy applied (up to the moment that the CSF sample was taken).[33] Others have used this method for obtaining CSF in order that a continuous monitoring of the symptoms and of the disease itself be accurately understood.[35] Working knowledge of intracranial gas tensions is useful for studies related to respiration, metabolism and cerebral tissue metabolism and aeration, factors which together control the extent to which permanent damage ensues after cranial trauma during disease. Prior to the introduction of the Ommaya reservoir, however, due to technical problems associated with placing needles in the brain, access to the CSF was very limited.[55] Other uses include the aid of pharmacokinetic studies,[32] the construction of carcinogenesis models using rat urinary bladders,[23] as well as improving the neuroradiological understanding of our brain due to the ease with which isotopes can now be placed in the body of the brain with a minimum of irradiation (due to an improved distribution of the isotope allowing improved data to be collected with less radioactive exposure to the route leading to the ventricles.[22])

Studies regarding the effluent of the thoracic duct can also be greatly expanded if more work is performed along the lines adopted by the group of surgeons who placed an Ommaya-type reservoir near the thoracic duct, with the goal of continuously monitoring the liquid passing through it.[26] The data gathered by this method may, in turn, trickle over to the related areas of hematology, renal and gastrointestinal physiology, experimental biochemistry and immunology. The Ommaya reservoir can be modified, by its use, to expand our knowledge of the circulatory system and biochemistry using a device that was originally designed for the amelioration of cranial symptoms due to fungal meningitis.□

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PSYCHIATRY

A Look At Electroconvulsive Therapy

P.J. Giannoccaro, 8T5

Electroconvulsive therapy (ECT) is a procedure used in psychiatry in which a current of electricity is passed through the brain, causing a seizure. Since its introduction forty-five years ago, it has evolved considerably to its present state. In the early days of ECT, the procedure was done without anaesthetic or a muscle relaxant: it was a disquieting procedure to watch. It was used indiscriminately throughout the spectrum of psychiatric illness. Now, ECT is done with the patient anaesthetized and paralyzed and only indicated mainly for those patients with severe endogenous depressions. It is, unfortunately, often the former procedural description which comes to mind when ECT is mentioned, promoting an inappropriate level of anxiety surrounding its use. The media to a great extent has propagated this image of ECT and made it a controversial issue for the public at large. (It must be stated that even within the medical profession there are some detractors of this procedure.) However, ECT as performed today is an effective and safe treatment if used with the proper indications and precautions. [2,7,12,14,15]

Indications

ECT was first used in treating schizophrenics,under the false assumption that schizophrenia and epilepsy were mutually exclusive conditions and that by inducing seizures in the schizophrenic, his symptoms would be relieved. Since there were few other treatments available for psychiatric illness at that time, ECT was expanded for use in affective disorders and personality disorders. Through this process it was found that some disorders responded to ECT whereas others did not. Today, the main use of ECT is in treatment of the major affective disorders. Severe endogenous depression with depression with vegetative symptoms of anorexia, psychomotor retardation, insomnia and early morning wakening, accompanied by suicidal ideation, favour a successful outcome with ECT.[12, 14] Severe mania is sometimes treated with ECT, as in schizophrenia. In the latter, it is the catatonic type which shows the best response to ECT although there have been published reports which indicate that ECT in conjunction with an antipsychotic agent was more effective than antipsychotic treatment alone.[17] ECT has also been effective in management of acute psychosis when antipsychotics failed or when urgency of treatment precluded their use. The patient should be willing to have ECT. It should never be used as a punishment or to modify unacceptable behaviour.[12] Furthermore, ECT has no place in the treatment of neurotic patients, substance abusers or those with personality disorders.

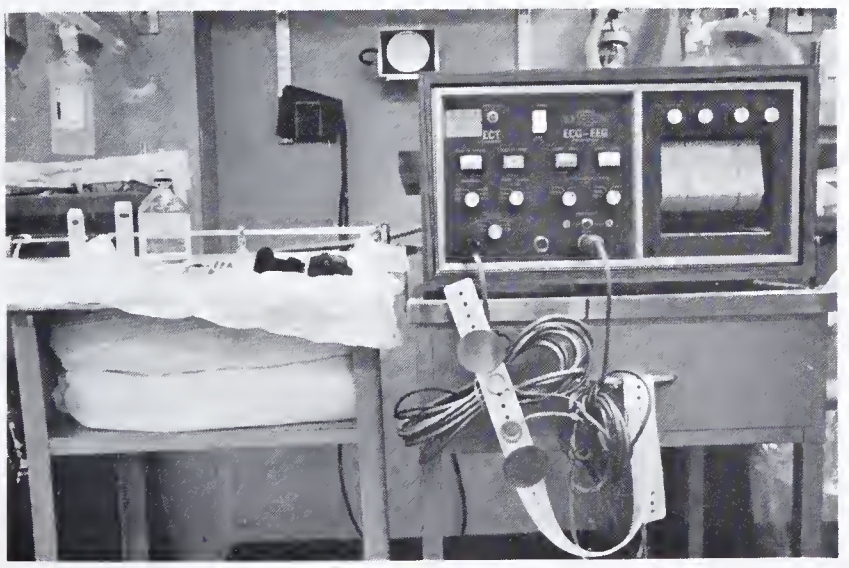

Fig. 1 ECT machine showing electrode headband with drug tray to the left. Drugs used for treatment include sodium methohexital, atropine and succinylcholine. Also on the tray is a "bite bar" and oropharangyeal airway.

Contraindications

The only absolute contraindication to ECT is raised intracranial pressure. Since increased blood flow in the brain at the time the current is applied causes a transient rise in intracranial pressure, "coning" or herniation of the brain could be precipitated by such inappropriate ECT use.[6] However, other contraindications are relative, and include recent cerebrovascular accident, recent myocardial infarct, and known cerebral or aortic aneurysm.[11,14] Cardiac pacemaker, pregnancy or old age are not contraindications, although in the latter, there may be increased risk of complications.[12]

Adverse Effects

Adverse effects of ECT may be attributed to either the central seizure itself or to the anaesthetic and muscle relaxant used in the procedure. The most common and clearly most publicized side effect of the central seizure is memory

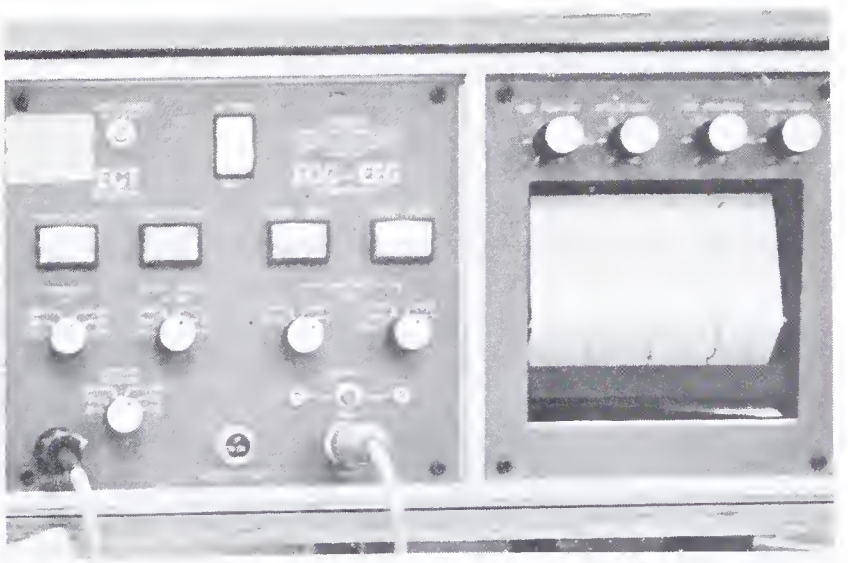

Fig. 2 Close-up of ECT machine. This is a newer model which features multi-parameter control of the current and has built-in EEG and ECG monitors.

impairment.[11] Indeed, ECT does cause impairment of short term memory for events prior to treatment (retrograde amnesia), and some difficulty in retaining newly learned information (anterograde amnesia). However, in many well done clinical trials there has been no evidence to prove that any long term impairments in memory occur.[3,9,16] Furthermore it has been shown that placement of electrodes in the bilateral orientation causes greater memory impairment than in unilateral placement over the non-dominant hemisphere, yet efficacy of treatment remains essentially equal.[1,5,10] Thus this side effect can be minimized by using the unilateral placement of electrodes. This initial memory impairment may be disturbing to patients but they should be reassured that it is only temporary and that full memory functions will return to normal, usually within a few weeks or months.[3]

Another adverse effect of the central seizure is cardiac dysrhythmias which result from inhibition of the SA node, allowing ectopic foci to pace the heart.[11] This is caused by an increased parasympathetic outflow during the seizure and can be avoided by administering an anti-cholinergic (atropine) prior to seizure induction. Headache, a common complaint of patients after the treatment is performed, may be due to increased intracranial pressure or muscle contraction, and is not serious.

Adverse effects of the barbiturate anaesthetic include anaphylactic reaction, cardiac dysrhythmias and hypotension.[13] The muscle relaxant most often used in ECT is succinylcholine which causes a depolarizing blockade of the neuromuscular endplate. It is broken down by serum pseudocholinesterase, and if there is any genetic or acquired abnormality of this enzyme problems may arise due to inadequate muscle relaxation during seizures or prolonged paralysis and respiratory depression. Serum levels of pseudocholinesterase can be measured and the dosage of succinylcholine adjusted to avoid these problems.

Thus, ECT has relatively few adverse effects and with a well trained treatment team, most can be avoided. Of course, the procedure is not risk-free, and, as with any surgical procedure, there is a small mortality risk, most often associated with the anaesthetic. The risk must, of course, be weighed against the benefits of the treatment. It has been shown that patients with untreated depression have very high mortality rate and that those treated with ECT have a lower mortality rate than those treated with other forms of antidepressant therapy.[2]

The Procedure

After the clinical decision is made to use ECT, the psychiatrist must obtain consent from the patient himself, if he is competent or a family member if the patient is incompetent.[11] A complete physical examination is performed along with an electrocardiogram and a radiograph of the thoracic spine to assess the fitness of the patient for ECT. Since a general anaesthetic will be used during the procedure, patients are required not to eat or drink eight hours prior to treatment (this usually means an overnight fast) to avoid possible complications of regurgitation and aspiration. Atropine is given to counteract the effect of vagal stimulation caused by ECT as mentioned above. Next, the general anaesthetic is given. This is routinely an ultra-short acting barbiturate such as sodium methohexital intravenously, producing rapid onset anesthesia of short duration (5 - 10 minutes). A muscle relaxant is also given to eliminate the peripheral seizure which is of the generalized tonic-clonic type. Succinylcholine is used to this purpose. During this period of flaccid paralysis the patient is ventilated with 100% oxygen to prevent hypoxia and hypercarbia (see figure 3). It is at this time, while the patient is at an adequate stage of anaesthesia and is paralyzed, that the electrodes are placed on his head. If the bilateral technique is used, one electrode is placed close to each temple. In the unilateral technique, one of two placements can be used. The electrodes can be placed near the temple and either posterior to the ear (figure 3) or to the right of the midline on the forehead on the non-dominant side (most often the right side). The lowest amount of current necessary to elicit a seizure is then passed through the electrodes. The seizure can be observed in the distal extremities as fasciculations of the muscles and usually lasts for approximately ninety seconds. Once the seizure is completed, the patient is brought to the recovery room. Here the patient is monitored for vital signs and usually awakes within ten minutes. Soon thereafter, the patient is released either back to the ward, if an inpatient, or home, if an outpatient. The number of treatments needed to relieve depression is usually between six to twelve with each treatment two days apart. Thus ECT is not a complicated procedure technically, but nevertheless requires trained personnel for its safe and effective administration.

Fig. 3a Unilateral placement of electrodes. Patient is given oxygen during the period of anaesthesia.

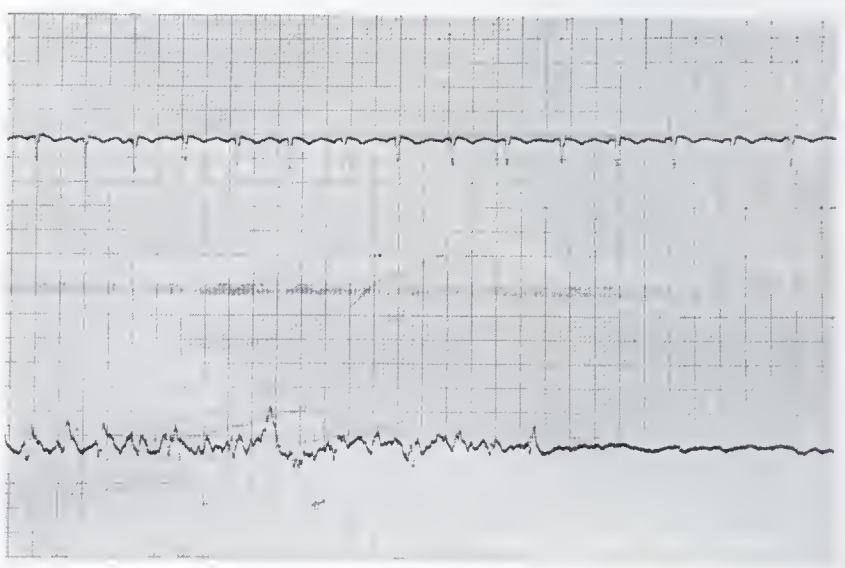

Fig. 3b An ECG with a normal sinus rhythm and EEG which has significant spike and wave activity during the central seizure which returns to normal once the seizure is complete.

How Does ECT Work?

It is not unequivocally clear how ECT works. It is clear however, that the therapeutic effects of ECT are mediated through the central seizure and not other aspects of the procedure.[8,19] It was felt by some that ECT merely scared the patient into a state of health; others thought that because the patient showed memory impairments that he forgot his depression and thus recovered. These theories have been left by the wayside in light of present evidence. The present hypothesis for the action of ECT suggests that it has an effect on the biogenic amine system in the brain. It alters levels of both neurotransmitters and receptor sensitivity.[4] Specifically, it was found that ECT causes a β-adrenergic subsenstivity and α-adrenergic and seritonergic supersensitivities, in post-synaptic receptors in the rat brain.[4,13] These effects are also seen with other treatment of depression, this lends support to a common mode of action.[4] It appears that ECT, the tricyclic antidepressants, atypical antidepressants and the monoamine oxidase inhibitors may work initially by increasing levels of biogenic amines at synapses and, by changing the receptor sensitivity to these brain neurotransmitters to cause a reversal of depression.

Summary

The effect of ECT is often dramatic and life saving. Its use in psychiatric practice is essential as it allows those severely disabled by their depression or those in whom antidepressant drugs have proven ineffective, to achieve a remission. This also holds true for those acutely psychotic patients in whom urgency or failure of drugs predicates its use. The risks to which a patient is subject are minimal, similar to any minor surgical procedure and most often related to the anaesthetic and not the central seizure itself. The adverse effects of ECT which are commonly experienced by patients include transient memory impairment and headaches. The procedure itself is not a complicated one, but does require the proper setting and trained staff to minimize any potential complications. The patient is anaesthetized and paralysed and an electrical current is passed through the brain, the whole procedure lasting no longer than ten minutes. The invoked seizure is thought to promote changes in the levels of biogenic amines and receptor sensitivity, thus reversing the affective disorder. There is no doubt that the controversy over the use of ECT will continue. However, Medicine remains empirical in nature and as such it can not dismiss this form of treatment until a more effective and safer method is found.□

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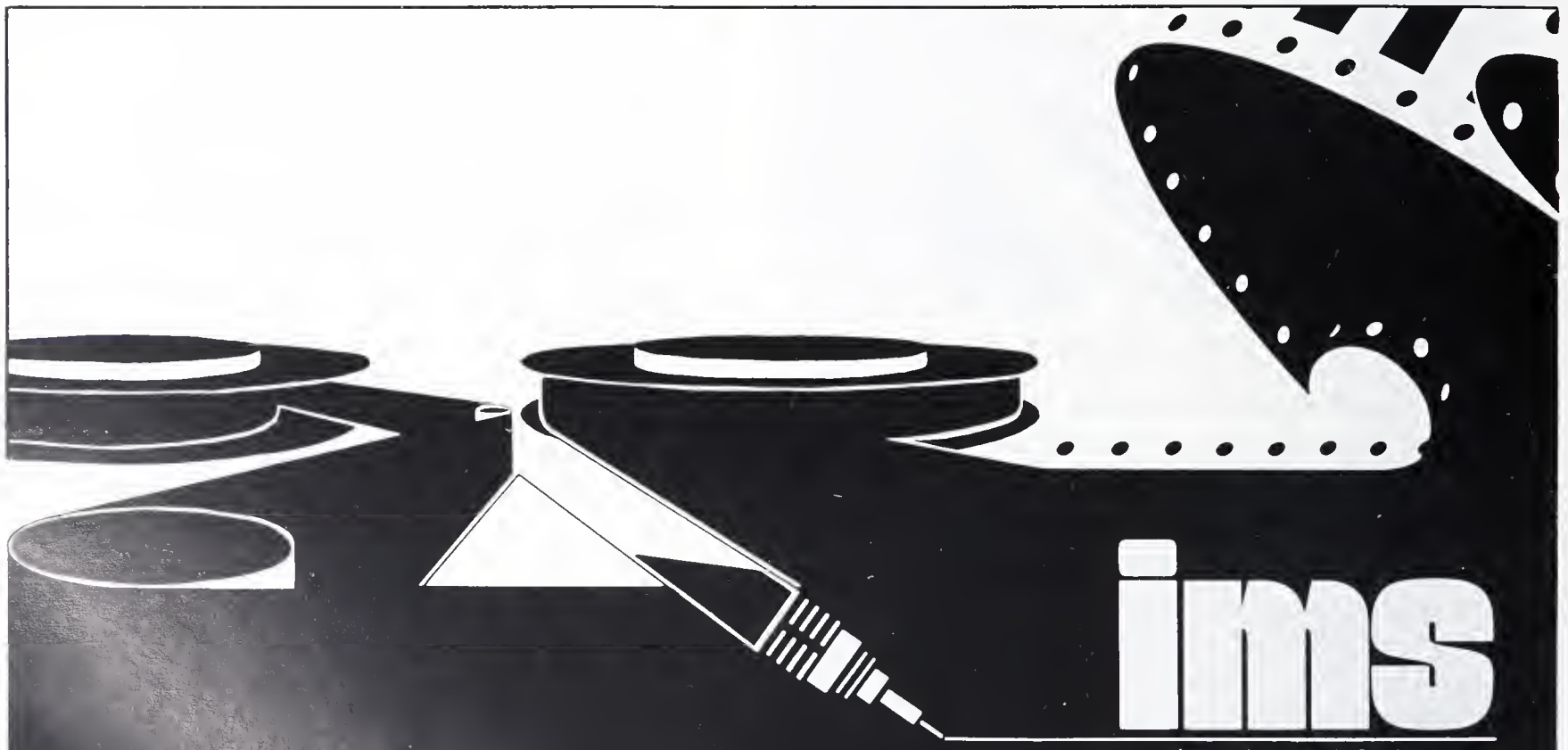

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RESPIROLOGY

Cystic Disease of the Mediastinum

Douglas Kondziolka 8T5

Cystic mediastinal disease can present in a patient with definite thoracic symptoms or in an asymptomatic patient on routine chest film. As a mediastinal masses, cysts must be differentiated from neoplasms and abnormalities in thoracic vasculature. The ability to localize a mass to a specific mediastinal compartment enhances the accuracy of preoperative diagnosis. Investigation into the differential diagnosis of a mediastinal mass will be discussed, as will the clinical behaviour of cysts versus other mass-producing lesions. A recent case report will be presented to demonstrate the assessment and management of a mediastinal mass.

The mediastinum contains a variety of structures representing many organ systems. Respiratory, cardiovascular, endocrine, gastrointestinal, lymphatic, neurologic and hematopoietic tissues are all present. With such diversity, it is not remarkable that various systemic diseases can manifest themselves clinically in this region.

The mediastinum proceeds from the thoracic inlet to the diaphragm below, laterally to the mediastinal pleura, anteriorly to the sternum and posteriorly to the vertebral column. It is divided into four main areas. The superior mediastinum contains the upper trachea and esophagus, thymus, aortic arch and branches. The anterior mediastinum contains thymus, as well as adipose, areolar and lymphatic tissue. The middle region contains the heart, pericardium, aorta, tracheal bifurcation and major bronchi and bronchial lymph nodes. Finally, the posterior mediastinum holds the esophagus, descending aorta and autonomic and peripheral nerves.[1]

In a study of 1881 adults with either a mediastinal tumor or cyst, 20% were found to have cystic disease. A similar study of 354 children disclosed 17% cysts.[2]

Many cases of mediastinal masses are first recognized on routine chest x-ray (CXR), or on CXR taken for systemic disease. As a result, one can conclude that many masses are asymptomatic. When recognized only via chest film, 95% of these tumors or cysts prove to be benign. However, 50% prove to be benign in two-thirds of patients presenting with symptoms related to the mass.[3] Table I delineates a classification of chest-film-determined mediastinal masses.

Table I. Mediastinal Masses on Plain Chest Film

Cysts	Neoplasms	Vascular Abnormalities
Pericardial	Neurogenic tumors	Aortic aneurysm
Bronchogenic	Teratomas	Aortic coarct/stenosis
Enteric	Thymomas	Brachiocephalic/tortuosity
Thymic	Lymphemas	Coronary art. aneurysm
Thoracic duct cyst	1° Carcinoma	SVC aneurysm/dilat.
Cystic hygroma	Endocrine tumors	Pulmonic stenosis
Misc.	Mesenchymal tum.	Pulmonary embolism
	Metastases	Pulm. hypertension
		Venous Return Abn.

Symptoms secondary to masses within the mediastinum include those attributable to compression or invasion of surrounding structures. Such symptoms include chest or back pain, dyspnea, dysphagia, or may be related to the presence of Horner's symdrome, superior vena cava (SVC) obstruction, vocal cord paralysis, spinal cord compression, pulmonic stenosis, chylothorax, tamponade and arrhythmias.[1] Also, many systemic syndromes and endocrinologic disorders such as hyperthyroidism and myasthenia gravis, are associated with mediastinal neoplasms. Hoarseness, Horner's syndrome and SVC obstruction are especially associated with a poorer prognosis.

Investigation

To determine the nature of a mediastinal mass, imaging techniques are of prime importance. Plain chest films are essential for showing location, size, adjacency to other structures and the presence of air/fluid levels or calcification. The value of obtaining an old CXR is indispensable in determining if the mass is an old or new lesion. (Figure 1)

Fig. 1 Chest Radiograph showing mediastinal mass entering the right hemithorax. This proved to be a bronchogenic cyst in the superior mediastinum.

Barium swallow technique is valuable for outlining any possible esophageal indentations, especially when a mass is causing symptoms of dysphagia. (Figure 2)

Fig. 2 Esophagogram (oblique view) showing marked indentation and deviation of the esophagus by a posterior mediastinal mass. This proved to be a thoracic aortic aneurysm.

Conventional tomography is used to divide the thorax into coronal sections, which by eliminating the presence of other structures, can then be examined in greater detail. Computed tomography (CT) has a pertinent role in assessing the mediastinum. It offers the opportunity to examine small structures (eg. lymph node enlargement) which might otherwise go unnoticed in other investigations.[4] The use of intravenous contrast agent to delineate the great vessels is invaluable in assessing mass proximity to other mediastinal structures, especially pre-operatively. (Figure 3)

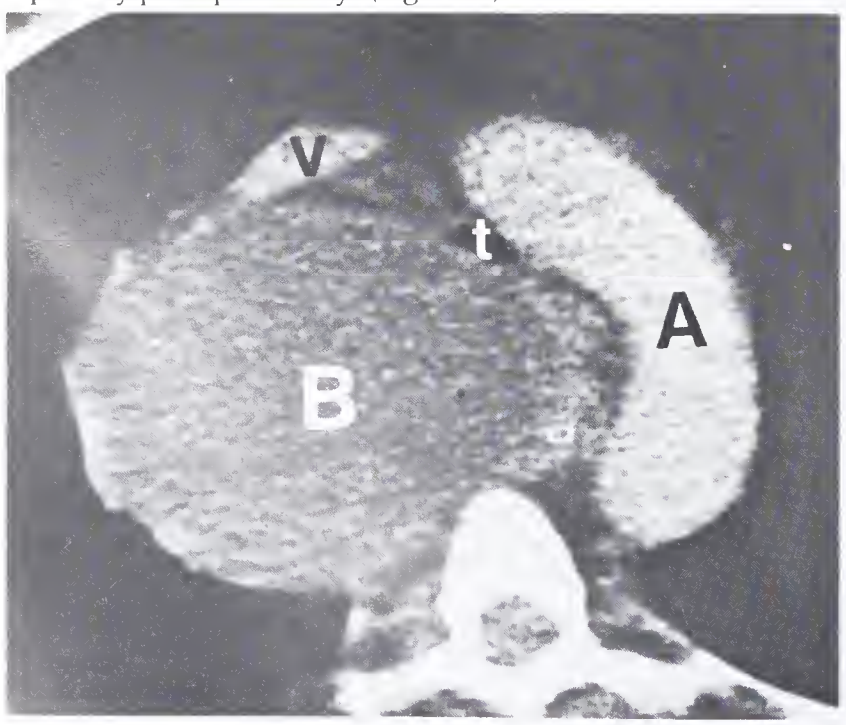

Fig. 3 CT scan of the thorax (supracarinal) showing a bronchogenic cyst (B) compressing the trachea (t). Contrast enhancement allows definition of other adjacent structures such as the aortic arch (A) and superior vena cava (V).

Other investigations include angiography if vascular abnormalities are suspected and myelography for neural involvement by cystic disease. Ultrasound has proven useful in delineating cystic disease but is rarely utilized presently due to the excellence of CT. Scintigraphy with ^{75} Se-selenomethionine has proved useful in detecting thymomas and malignant lymphomas. It has a high uptake in lymphogenous tumours but not in bone marrow. Cysts, vascular diseases and benign neurogenic tumours all give a negative scan.[5] The use of radioisotope scans for ectopic thyroid tissue or parathyroid disease is well documented.

Besides lesion delineation, these techniques are necessary to rule out associated vertebral and esophageal anomalies as well as mediastinitis. Complications arising from the mass (ie. compression) can also be assessed.

Bronchoscopy, esophagoscopy and bronchography are rarely indicated for diagnostic purposes.[6] However, bronchoscopy may be useful to examine bronchial anatomy prior to thoracotomy.

Pathologically, a mediastinal mass may prove to be malignant. If metastases are obvious, radiological investigation may be all that is required. However, for a single lesion, definitive diagnosis often requires tissue examination. As a result, thoracotomy may be necessary for diagnosis and/or treatment.

Mediastinal Cysts

Pericardial Cysts

These comprise the largest cystic group in many series. They are most commonly located in the anterior mediastinum or the anterior costophrenic angle.[7] Pericardial cysts are benign, only occasionally symptomatic and are usually separate from, though may rarely communicate with, the pericardial cavity.[1] They are said to originate from abnormal folds of empbryonic pleura[8] or from a fusion failure of the pericardial lacunae. Ultrasound and cyst puncture for fluid aspirate determine whether or not a cyst is benign. However, this technique cannot distinguish from other fluid containing smooth walled cysts.[9] Surgical excision gives both histological diagnosis and treatment via thoracotomy.

Bronchogenic Cysts

Bronchogenic cysts are often located close to the trachea or mainstem bronchi in a position commonly posterior to the carina. However, the posterior mediastinum is their most frequent location.[7] They originate from the developing ventral foregut via partial segregation of the lung bud and can occur within the mediastinum or in lung tissue itself.[10] A connection may exist between the cyst lumen and the tracheal lumen. On the other hand, there may be either no connection or one consisting only of a cartilaginous tract remnant.[1] Should an open bronchial communication be present, then cyst infection can occur. Although histologically different, this infected cyst may be difficult to distinguish from a lung abcess.[11] Sectioning of the cyst wall shows ciliated respiratory epithelium, cartilage, smooth muscle and mucus glands but no alveolar element.[1]

There are many reported cases of cysts containing both respiratory and digestive tract epithelium.[11] These bronchoenteric cysts may have esophageal, gastric or rarely intestinal mucosa as their enteric component.

When symptomatic, bronchogenic cysts may present with cough, dyspnea or stridor due to their close approximation to major respiratory passages. However, in the infant, signs of respiratory distress (chest retraction, wheezing, increased anterior-posterior chest diameter, decreased breath sounds and cyanosis) should alert one to more common causes, for bronchogenic cysts rarely present in this manner.[1] For example, bronchoscopy for foreign body aspiration may be indicated.[12]

Chest films usually show a smooth mediastinal density (Figure 1) or may detect esophageal compression on barium swallow. Bronchogenic cysts have never been reported to be associated with vertebral abnormalities.[10] Thoracotomy is indicated for symptomatic relief or tissue diagnosis although malignant degeneration has not been reported.

Enteric Cysts

Enteric cysts (also called enterogenous, reduplication, inclusion or gastric cysts) originate from the dorsal foregut division and are usually in the posterior mediastinum.[13]

Notochordal splitting by a dorsal herniation of endodermal foregut (split-notochord syndrome) may result in a dorsal sinus, a dorsal enterocutaneous fistula or a posterior mediastinal cyst. The remnant is determined by which part of the herniation persists.[10] From this development, the cyst is usually attached by a fibrous band to a vertebral body. Spinal abnormalities can occur and include hemivertebrae, incomplete fusion of neural arches, spina bifida and scoliosis.[6]

Histologically, an enteric cyst has a smooth mucosal lining typical of esophagus, stomach or small intestine. Often the cyst is attached to the wall of the esophagus, although it may be embedded directly in the esophageal wall.[1] This intramural cyst is thought to form when a defect in embryological canalization of the esophagus occurs, leaving a persistent vacuole within the wall. This intramural type has never been seen with vertebral anomalies. A symptomatic presentation may be due to compression, although ulceration, perforation and bleeding are recognized complications.[10]

One variant, the neurenteric cyst, may be attached to the meninges or spinal cord via a tract with neural elements. This tract can be patent and visualized by myelography.[1] As for either enteric cysts, thoracotomy may be indicated for these types of cysts.

Thymic Cysts

Thymic cysts are often considered as being of congenital, inflammatory or neoplastic origin and are usually in the anterior mediastinum. However, progressive enlargement may send the cyst into any mediastinal division including as inferiorly as the diaphragm.[6]

Cyst formation usually occurs from the thymopharyngeal ducts, sections of the bronchial cleft, or involutions within the thymus. Congenital cysts can reach massive size. Inflammatory types may have congenital syphilis or tuberculosis as their cause.[7] Thymic neoplasms will be discussed under Mediastinal Neoplasms.

Thoracic Duct Cysts

These are very rare with seven reported cases as of 1979.[14] More common cysts must first be ruled out by CT, barium swallow and aortography before their confirmation by lymphangiography. A degeneration or congenital weakness of the duct wall, possibly related to infection, may cause duct cyst formation.[15] They have been complicated by chylothorax.

Miscellaneous Cysts

Cystic hygroma is a benign congenital tumor of lymphatic origin most commonly found in the neck rather than in the mediastinum.[6] However, larger neck cysts may extend down into the superior mediastinum. As opposed to other cysts, these are multilocular. Chylothorax can rarely be a complication.

The anterior thoracic myelomeningocele is a cystic lesion communicating with the vertebral subarachnoid space, frequently associated with neurofibromatosis.[7] It may present in infancy with compressive symptoms resulting from its often large size.

Mediastinal Masses of Vascular Origin

Abnormalities within the pulmonary or systemic circulations can present as a mediastinal mass. The processes of vessel obstruction and decreased valvular integrity are commonly of prime importance.

Enlargement of the pulmonary arteries can result in a hilar mass. Pulmonic valve stenosis can dilate the artery via flow turbulence. Dilatation can also occur secondary to longstanding pulmonary hypertension or congenital absence of the pulmonary valve. Massive pulmonary embolism can lead to unilateral hilar enlargement from single arterial dilatation.[16] These disorders may produce an increased ventilation/perfusion ratio with a presentation of systemic hypoxia.

Brachiocephalic vein enlargement through partial or total anomalous pulmonary venous return can lead to a mediastinal "snowman" on chest film in the superior mediastinum.[16] This variant has even been described in a fifty-two year old man.[17] Pulmonary venous confluence due to grouping of upper, lower and/or middle lobe veins proximal to the left atrium can present as a middle mediastinal mass.[16] Respiratory manoeuvres during fluoroscopy or conventional tomograms showing continuity of distal veins with the mass may lead to a diagnosis of this confluent vein anomaly.

Thoracic aortic aneurysm (due to atherosclerosis, trauma, syphilis or vasculitis) is the most common vascular cause of an adult mediastinal mass.[16] (figure 2) Contrast enhanced CT may be helpful as normal aortographic findings do not rule out a clot-filled aneurysm.

Aortic coarctation may lead to a left superior mediastinal mass. Loss of aortic knob outline on a frontal film CXR can be a helpful clue in this case.[18] Aortic stenosis (AS) can produce a right perihilar bulge which may show calcification. The clinical presentation of AS and a crescendo-decrescendo systolic murmur are usually diagnostic.

Large aneurysms and fistulas of coronary arteries may be detected. One series noted localized coronary aneurysms in 1.4% of autopsies.[16] Brachiocephalic artery tortuosity, common in the elderly, may produce a superior mediastinal or apical lung mass.

Finally, systemic venous anomalies include aneurysm or dilatation of the SVC. A left SVC has been found in 5% of people in the absence of such disease.[16] Azygous vein enlargement secondary to right heart failure, constrictive pericar-

ditis, pregnancy, SVC obstruction and arterio-venous fistulas, can lead to a right paratracheal mass.[19]

Pulmonary sequestration is a rare, congenital malformation in which an area of lung tissue derives its blood supply from an anomalous systemic artery.[1] The more frequent intralobar type is usually found within one of the lower lung lobes and is not often associated with other congenital abnormalities. The extralobar type has its own pleura and is associated with other thoracic abnormalities in 50% of cases. Communication with the gastrointestinal tract by either form of sequestration has been described.[11] On chest film, the extralobar sequestration often presents as a triangle shaped density with its apex pointing to the hilum.[1]

Mediastinal Neoplasms

Neurogenic tumors, composing 38% of mediastinal tumors and cysts in children, are usually in the posterior compartment.[1] Often stemming from either intercostal nerves or the sympathetic chain, they are mostly benign (neurofibromas, neurilemmomas) with a greater tendency towards malignancy in children. Malignant types include neurogenic sarcomas and the highly invasive neuroblastoma. Malignancy has also been demonstrated in 50% of mediastinal pheochromocytomas which may present with symptoms of adrenergic hyperactivity.[1] A small group of neurogenic tumors are contiguous with interspinal tissue which may result in pain or focal neurologic signs. Routine myelography for infants or children with paravertebral masses has been proposed because of the increased risk of malignant transformation.[20]

Teratomas, of which approximately 86% are benign, may be solid or cystic (Dermoid cyst). These may contain the ectodermal elements of brain tissue, hair, teeth, sebaceous material and squamous epithelium. Symptoms are due to compression or rupture induced pneumonitis.

Thymomas are common mediastinal neoplasms in adults, although rare in children. Located in the anterior or superior mediastinum, they may be locally invasive, which is their greatest indicator of malignancy.[1] Ten to fifty percent of cases are associated with myasthenia gravis (MG) and have a poorer prognosis. However, only 8-20% of MG patients have a thymoma.[21]

Involvement of mediastinal lymph nodes with primary or disseminated lymphoma may enlarge the hilar areas, creating a mass appearance. On plain films, enlarged right and left paratracheal nodes as well as distortion of the mediastinal pleura may be evident.[22] Any mediastinal compartment may be involved although the anterior is most common. Metastic or primary carcinoma can lead to nodal enlargement. Occasionally, squamous cell carcinoma can be demonstrated in these nodes in the absence of a primary lung focus, although these probably are metastases.[1]

Other neoplasms include thyroid tumors, parathyroid adenomas and mesenchymal tumors (i.e. lipomas, fibromas). As well, seminomas can present in the mediastinum, and are often as primaries.

Case Presentation

A 28 year old woman was admitted to hospital because of an intrathoracic mass.

She presented to hospital emergency room after having been assaulted. At this time, a CXR was obtained to eliminate the possibility of chest trauma or rib fracture. This radiograph demonstrated a circular, well delineated intrathoracic mass posterior to the heart. (Figure 4)

Fig. 4 Chest Radiograph disclosing a homogeneous density partially obscured by the cardiac silhouette. A lateral film places the mass in the posterior mediastinum at the level of T10.

The patient complained of occasional anterior chest pain and some low abdominal back pain over seven years, but was otherwise healthy. No pleuritic component could be identified, nor was there any history of gastrointestinal upset. The patient had undergone several laparoscopies for the pain. She was allergic to penicillin.

On examination, the patient looked well. The chest examination was normal. The abdomen revealed a scar above the pubis. There were no hernias, no masses and no organomegaly. Rectal examination was normal.

The hematocrit was 44.2%; hemoglobin was 14.7 g/dl; the white cell count was 14,200 with 52% neutrophils, 42% lymphocytes, 3% monocytes and 3% eosinophils. The platelet count was 289,000. The sodium was 140 mmoll, the potassium 4.4 mmoll, the chloride 102 mmoll and the carbon dioxide 24.5 mmoll. The urea nitrogen was 5.2 mmol/l, glucose 4.4 mmol/l, calcium 2.34 mmol/l and the bilirubin 6.8 umol/l. A specimen of blood drawn while the patient was breathing room air showed that the partial pressure of oxygen (PaO_2) was 65 mmHg, the partial pressure of carbon dioxide ($PaCO_2$) was 40 mmHg and the pH was 7.42. When breathing an FiO_2) of 90%, the PaO_2 was 154 mmHg, the $PaCo_2$ was 39mmHg and the pH was 7.36. The albumin was 4.4 g/dl and the prothrombin time was 10.4 seconds. An electrocardiogram was normal.

A barium swallow was ordered and disclosed free-flowing barium through the esophagus into the stomach. A soft tissue density consistent with a posterior mediastinal mass was noted just left of, and lateral to, the tenth thoracic vertebrae. A CT scan revealed a solid mediastinal mass plus a hyperlucent area of lung which seemed to be supplied by an abnormal vessel. (figure 5) Bronchoscopy was performed and the tracheobronchial tree was found to be normal. A thoracic aortogram via the right femoral artery demonstrated the aberrant artery as well as a small vessel supplying the dense area of the lesion.

Fig. 5 CT scan of the thorax at the level of T10. The descending aorta lies directly anterior to T10. Note the presence of a circular mass lateral to the aorta in the left posterior mediastinum.

A left thoracotomy was performed and the mass resected. Two aberrant vessels, feeding abnormal lung tissue, were clamped and excised.

Pathology reported a 3.3 x 2.4 x 1.5 cm thin walled cyst containing mucinous fluid. The segment of abnormal lung measuring 6 x 4 x 2 cm contained a dilated bronchus consistent with an accessory lung. This was clinically suspected to have been a pulmonary sequestration. Lymph node examination showed no evidence of malignancy.

A diagnosis of a bronchogenic cyst (posterior mediastinum) and an accessory lung was made. The patient did well and her post-operative course was unremarkable.

Summary

The differential diagnosis of a mediastinal mass encompasses a wide range of disorders. Mediastinal cystic disease commonly results from disorders in early thoracic development. Although predominantly benign in nature, complications from structure compression or local invasion may lead to a symptomatic presentation.

Whether symptomatic or not, a mass must be investigated for malignant potential. Much of this assessment is radiological, although thoracotomy is often indicated for tissue diagnosis.

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TAB. XXXIV.

78 The upper Surface of the Diaphragm, next the *Thorax*.

A The Right Side.

B The Left.

C That part of the Diaphragm, which ariſes from the *Cartilago Enſiformis*.

DEF Thoſe Parts, that ariſe from the *Vertebræ* of the Loins.

GG From the two laſt Ribs.

HH From the Cartilaginous Endings of the Ribs next the *Abdomen*; whence its fleſhy Fibres paſs, till they become tendinous, II, where they decuſſate each other in various Angles, according to their ſeveral Directions, from their different Originals at A, B, C, D, E, F, G, H. Nor do they ſeem to terminate here, but each tendinous Fibre is continued to its oppoſite fleſhy one, making as it were ſo many Digaſtrick Muſcles, in which are two conſiderable Perforations; the one for

K The *Vena Cava*, the other for

L The *Gula*.

M A Portion of the Trunk of the *Arteria Magna*, in the Fiſſure of the two Productions of the Diaphragm, where the *Vena ſine pari* and the Thoracick Duct alſo paſs.

Diaphragma TAB. XXXIV

W. Cowper, *Myotoma reformata*, R. Knaplock, London, 1724.

ETHICS

Ethical Concerns of Medical Students

Arthur Rotenberg 8T5

A group of students at Toronto Western Hospital participated in a discussion of ethical concerns encountered during bedside clinics. Eleven of the thirteen participants formally evaluated the discussion and all indicated that they would like to have similar sessions several times per year.

In December, 1983, thirteen third-year Medical Students met to discuss "ethical" issues that they faced while seeing patients in hospital-based teaching clinics. The purpose of the meeting was to allow students to voice emotions which could otherwise interfere with their learning. The discussion was led by Dr. John Scott of Women's College Hospital, and focused on three issues:

1. Using patients as objects of learning. Students found it troubling that they were examining patients without helping them or contributing to their immediate care.
2. Informing patients about their illness. Students were often disturbed when staff doctors withheld from patients details about their prognosis.
3. Invasions of patient privacy. This included such problems as doing rectal exams and presenting a patient's illness at his bedside.

Two of the conclusions from the discussion which students found reassuring were:

1. Patients benefit from having students listen to them, particularly in a setting where few hospital staff have time to listen.
2. In helping a medical student to learn, patients regain much of the dignity which is lost in being admitted to a hospital.

Eleven of the thirteen participants evaluated the discussion. They all rated it above lectures in their Community Health course and Ethics elective and wrote that they would like to participate in such sessions 3 - 6 times per year.

Staff support sessions similar to this occur in a few hospitals, (see bibliography) and they are often in palliative care settings where staff experience a lot of stress. The success of such discussion groups seems to depend mainly on the quality of the discussion leader and the group dynamics of the participants. Both of these factors seem to have contributed to the success of this session.□

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as-so´ci-a´tion

----a voluntary organization of persons joined together to pursue a common purpose or objective common to all.

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PAEDIATRICS

Mother-infant interaction part 2: Emotion and attachment

E.H. Keay M.A. 8T5*

The degree of attachment between a mother and her child can be estimated by trying to label either the behaviour or the change in some physiological parameter of the child, such as the heart rate. These parameters are unreliable in the first three days or so because the blood pressure, respiratory rate and heart rate are not stabilised, and some, such as REM sleep, thermoregulation, ACTH metabolism and steroid metabolism, are not regulated until the fifth day after birth (Discussion 1969). This is for normal babies, and the heart rate, blood pressure and EEG may take longer to regulate in mildly brain damaged infants (Discussion 1969). Epidural anaesthesia causes disorganization in the baby on the first day which goes away largely by the fifth day, but with some lingering effects for a month (Murray 1981). This may affect the "sensitive period" mentioned below, especially of the primipara (Murray 1981). Other perinatal drugs affect the heart rate for up to twelve months after birth (Brackbill 1979), depending on the potency of the drug, and those who have used this parameter do not often mention a drug history of the pregnancy, thus bringing some other conclusions into doubt.

Physiological Paramters of State

There is some confusion as to whether heart rate is of value in interpreting emotion and state of arousal. From five to twelve months, the heart rate increases in negative expression and decreases with positive expression, the expression being classified according to an adult scale (Field 1982). However, Stoller (Stoller 1982) has found that the smiling child's heart rate may increase *or* decrease, but in the gaze-avert the heart rate decreases and at seven months heart rate increases with separation anxiety (Izard 1982). The reason for the ambiguity in the smiling response may be because the heart rate indicates not so much the affect as the activity or inactivity of the infant vis a vis an aversive event. Such a "phasic" heart rate should be replaced by a "tonic" heart rate, an average over time (Obrist 1982). The systolic blood pressure could be used the same way (Obrist 1982). Another reason for the unreliability of the heart rate is the tempramental variables that appear after the first year (Izard 1982). The variability may also be due to the timing of the heart rate since changes in it may lag somewhat after the sensory perception. The heart rate of the looking and smiling child drops and then increases, (Stoller 1982) so one must monitor the heart rate longer. Some think it shouldn't be used at all because there are too many variables (Dunn 1979).

Another pattern investigators have used is the EEG pattern, which, as noted above, takes a few days to stabilize after birth. It shows the changing states of arousal, especially sleeping and waking. There may be two major periods of change in this pattern: from birth to two and one-half months and from five to nine months so there can be little information on the stability of individual differences at this time (Dunn 1979). During the first period, the baby is organizing himself, and for the first two months the baby is independent of the environment so long as his basic needs are met (Sameroff 1978). The child is changing rapidly at these times and no accurate measurement can be made (Sameroff 1978) except to say that changes *should* be happening at these times. Berg and Berg have set out some of the complicated changes. The full term infant has many periods of REM, corresponding possibly to an immature restibular system, and the EEG burst pattern of adults is present by three or four months. The heart rate becomes less variable in quiet sleep by one month and in active sleep by two to four months. The organization of the infant for the first month is to sleep for sixteen or seventeen hours a day with no diurnal variation but, by the middle of the second month, a diurnal pattern is beginning to emerge with more sleep at night. The kidney reaches a diurnal pattern by two years. The newborn begins sleep with active sleep (Brackbill 1979) and it takes six months to change to an adult pattern of sleep with NREM onset sleep (quiet sleep). All babies immediately after birth are awake. There is a sleep-wakefulness cycle with NREM sleep in babies with the periods of wakefulness dependent on feeding (and so available for the maximum interaction with the mother); and a basic rest activity cycle with REM sleep and periods of enhanced alertness while awake. In the newborn, both of these cycles may be regulated in the brainstem but the sleep-wakefulness cycle is shifted to the thalamocortex, and is paralleled with increasing awareness of the environment (Berg 1979). One might assume that any biochemical or neuronal abnormality, however small, would affect the infant's perceptions of his world, especially his mother, and so affect his attachment to her. Both mothers and physicians should be aware that for the first nine months babies are in great physiological flux. Perhaps there will be EEG norms or ranges, established and these could be used as another way of evaluating personal development and behaviour.

There may be hormonal factors affecting the baby's interaction with the world. As mentioned above, these do not stabalize for the first few days. Anoxia may result in an

** The first part of this paper discussed normal and abnormal mother-child interactions. It appeared in the previous issue of the Journal. The paper was written as part of the experimental community Health Seminars.*

inability to deal with stress when the infant is older since ACTH is not inhibited as it is normally in this situation (Brackbill 1979), and the plasma contisol level, especially 17-hydroxy corticosteroids, may give an idea of the intensity of emotion within an infant, since the levels are raised in a one-year old if being separated from his mother produces an anxiety which is relieved by her happy return. The child who ignores his mother's return will have lower levels (Tennes 1982). This may show an "abstract" link to the mother or point to synchronics we do not know about yet! These may also have a predictive value in the future.

Behaviour Assessment

There are assessments of the newborn, described by Self (Self 1979), but two, the Apgar and the Neonatal Behaviour Assessment Scale (NBAS), will be discussed very briefly here. A low Apgar may correlate with decreased visual attending, head turning and increased crying, but may not correlate with later neurological tests (Self 1979). The Brazelton NBAS is supposed to assess both the young infant's (thirty-seven weeks premature to one month old) response to the environment and effect on the environment, and the effect of prenatal and natal events (Self 1978) by twenty neurological and thirty-seven in behavioural parameters. It is regarded as quantifiable and subjective (Packer 1979) and thus a tool for evaluating future mother-infant attachments. However, the day-to-day stability of the information is low, and there is little correlation with later behaviour because the infant is changing too rapidly (Sameroff 1978), and the behaviour between the mother and child is also changing rapidly (Sameroff 1978). A modal approach would be better for assessing social interaction where the mother can also apply parameters of the test as well as an examiner, thereby avoiding the problem of the examiner trying to elicit the same response in different babies, and where *both* the mother and child can be observed by a trained examiner (Sameroff 1978). The evaluation of NBAS seems to be in flux (Vaughan 1980).

Laboratory Assessment

An extension of the hospital assessment of the newborn with its *caveats* for physicians is the laboratory observations of the mother-child interactions and the *caveats* for readers, including the readers of this paper. The laboratory set-up is artificial and it is very difficult to apply statistics to attachment behaviour (Packer 1979). Multivariate analysis is often required (Vietze 1980). The interaction that is being observed cannot be considered independently of previous one (Packer 1979). One must also realise that the mother will not display negative behaviour while being observed (Brooks-Gunn 1982), thus skewing the information at the primary level. The examiner must keep his views and the subject's views distinct (Blurton Jones 1979) but video (Packer 1979), especially when subjected to microanalysis, may be more objective. Microanalysis involves describing the relationships of events within a session over time (Kay 1982). By such a close analysis, one attempts to determine the underlying characteristics of each partner in the interaction, whose actions are determined by the prior behaviour as noted above, as well as by the behaviour of the partner at that moment (Martin 1981). There is thus a cumulative affect (Schaffer 1977). However, there are disadvantages to microanalysis: the frame-by-frame analysis creates much data and so the sample size tends to be small, and the mass of detail makes it difficult to generalise or find the right categories and labels (Schaffer 1977). Both partners should be examined so there is both intra-individual and inter-individual data and analysis which may be arranged in a heirarchical structure (Schaffer 1979). There may be either a simpler structure underneath (Ainsworth, Bell 1969) or unidimensional traits may cover up more complex interrelationships (Dunn 1979). Dunn also notes that the source of variation in the studies is the rate of development itself (Dunn 1979).

Describing Emotion

Aside from the problem of analysis, one must decide how the events are going to be labelled and coded (Dunn 1979). If one asks the mothers to explain how their infants are reacting, they will use different labels: in the separation experiment the mothers might say "scared" or "upset" which is interpreted as "close behaviour" or "miss me" which is less "responsive" (Lewis 1982). Not only is the mother's labelling subjective, but so is the examiner's, because we are dealing with defining emotions which are indefinable. Indeed, there is some confusion as to what emotion is as is seen in the following definitions. There is no single brain mechanism for emotion (Izard 1982). It is a neurophysiological - biochemical, behavioural - expressive and experimental - conscious process, and data from one of these three criteria is indicative but not sufficient to identify the specific emotion or even to verify that it occurred (Izard 1982).

Emotions tend to occur in patterns or sequences, sometimes with rapid shifts in emotion signals (Izard 1982). Emotion is regarded by Schwartz as a system within a system with patterns of subjective experience, skeletal muscle activity, ANS and CNS activity and combinations of these responses make up emotion (Schwartz 1982). Such patterns are easy to detect in people who can speak (Schwartz 1982). Lewis defines emotion as an elicited change in the physiological state with the elicitor being internal or external; a change in the surface expression; perception of the event and then evaluation by the individual (Lewis 1982). The last two, perception and evaluation,comprise the emotional experience which is a select vocal, postural and facial behaviour and has content (Lewis 1982). There are specific states, such as fear, which are determined early in life, remain relatively constant and varying only in the elicitor (Lewis 1982). Socialisation soon masks the emotional expression and underlying state (Lewis 1982): in the infant the two are openly connected while in the mother they are not. The meaning of emotional expression is inferred from the facial, vocal and bodily acts as observed in a particular content (Brooks - Gunn 1982). Emotion labelling depends on the fixity and universality of expression and not socialisation (Lewis 1982). This may hold true for babies but it probably does not hold for mothers because the lab situation is highly artificial and the mothers are socialised. Lewis sets down some problems in analysing emotion: how to express emotion; when to express them, as situations have expectations associated with them early on in a child's life; how they are managed or "acting appropriately" as learned by interacting with significant others; how they are interpreted when the emotional state becomes associated with specific emotional experiences by the parent's attributing emotions to the infant before he can experience them, and so the infant or child learns to interpret his own state (Lewis 1982).

Blurton Jones has given a detailed list of all the variables that should be combined when studying interactional behaviour, in an attempt to put the emotions in the correct context. The list is long, and laudable, but probably no study would take the care to take such detailed information as the analysis would be horrendous! (Asterisks mark those I would consider important for a minimum). Here is the list: perinatal and infant mortality; *nutritional levels and variations within the culture; *amount of observation indoors and out; *people present with mother and child, who and how often; nature of floor and furniture, the physical situation; *baby care devices; temperature and precipitation outside; *physiology and behaviour of newborn; *obstetric practices, history of sample of live newborns; *nature and quality of mother's helpers, sibs, relatives, neighbours; *child's social contacts, residence pattern and opportunity for interaction with others; *disease history of the child; *individual parent's aim and theories of child rearing; *mother's social contacts, quality of marital relationships; *subject's responses to observers (Jones 1979). One might add: *parents attitude to the *sex* of their child; *birth order of child; **detailed* histories of parents including social class and childhood.

Describing Attachment:

If one has trouble deciding what emotion is and how we are going to study it, how much more difficult it is going to be to study the complex accretion of emotion presented as attachment behaviour of the mother to her child? For one thing, there is dispute as to what attachment is, as is shown by the following set of definitions. Trevarthen thinks "personal relationship" should be used instead since it gives a better description of the communication process which has grown up between the infant and mother or other most attentive person (Trevarthen 1977). This term seems to deny that the mother has any special relationship to her child, and so I shall use the term "attachment." Ainsworth describes attachment as behaviour used by the baby to discriminate his mother from others. He responds to her differently in the following ways: crying; smile; vocalise; visual motor orientation to her; cry when she leaves; climbing over her; burying his face in her lap; using her as a secure base for exploration; cling and fear-cling; lift arms in greeting; claps hands in greeting (Ainsworth 1983). There are three variables that determine the strength of the attachment: the amount of care the mother gives to the child, her interest in the child, and her enjoyment of breast feeding (Ainsworth 1983).

Schaffer sees it as a narrowing of response from the environment to humans to a specific human because of increasing stimulation and responsiveness of her (Schaffer 1963). He later sees it as a perception by the mother that the infant is an essential part of her life, around the third month for primipara (Scjaffer 1979). Richards sees it as a bonding process in the first few days after birth in contradistinction to Bowlby who saw it in relation to separation after attachment after six months (Richards 1979). Klaus sees it as reciprocal and interlocking behaviour at birth since the infant is in a precarious state: he needs warmth, protection, feeding (Klaus 1975). His colleague, Kennell, in the same volume, sees it as specific and enduring through time. It is not the same as imprinting since there is not a point beyond which attachment is precluded. The period after birth is the best time but not the only time (Kennell 1975).

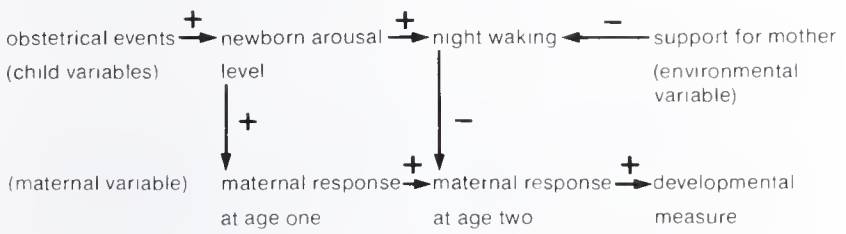
Leiderman feels that mothers feel attachment to babies first and then *her* baby (Leiderman 1975). Massie has followed Bowlby in saying that bonding is from birth to six months and attachment from six months to twelve months (Massie 1980). Stroufe considers attachment the enduring affect of a child and his mother, with the affect acting as an indicator of the quality of the attachment (Stroufe 1979). The patterns of the attachment behaviour reflect the arousal level and vigour of the child (Ainsworth, Bell 1963). The idea of attachment is in terms of the mother. For the baby, attachment is not sensed until the infant has an idea of "object permanence" of his mother (Stroufe 1979) which correlates with the development of either the Piagetian recall memory of internalised images or the schema model which is the organisation of past reactions or experiences causing similar impulses to be lumped together (Werner 1979). This is around nine months when the child begins to suffer stranger anxiety (Stroufe 1979).

There is some question as to whether there is a "sensitive period" (Osofsky 1979) within the mother during which the optimum bond is formed. At the first hour after birth, the normal infant can track a face, and is awake for seven hours, an excellent period for interaction (Packer 1979). The mother is in a state of primary maternal preoccupation which begins to increase towards the end of pregnancy and lasts for a few weeks after birth. The mother's memory of her state of mind at this time is repressed (Richards 1979). Part of this state is the mother's fantasizing about her child, mentioned elsewhere, which changes when the baby is born and, though in a preoccupied state, she needs support of her husband and friends (Richards 1979). As mentioned below, many workers have tried to show that most acts in this early period have almost irrevocable effects, and it is instinctively and intellectually pleasing if this early period of the adjustment did not have a long term effect (Dunn 1975, Jones 1979) since child and mother are getting to know each other. However, it is unclear whether extended contact during nursing has maximal effect by the first week post partum and no residual effect by the sixth week, and this may be because the statistical subject is minimised as is the Hawthorn effect where mothers in an experimental situation giving extra contact are influenced by expectations placed on them (Schuller 1979). Schuller considers continuous baby contact as unnecessary for survival, but the adventitious emotional benefits are valuable.

Maternal-Infant Behaviour

Having set out briefly attachment theories between mother and child, it is now the time to show how the sensory cues, the emotional expression and contexts combine to constitute maternal-infant behaviour, a catch-all term. Behaviour and emotion have not, and will not be held in strict definition as perhaps they should be (Lewis 1982). Before giving observations on mother-infant behaviour, it might be useful to summarise Gewirtz and Boyd's ideas on the history of research in this area. It was first believed that the parent was the primary determinant of child behaviour, then there was the ethological theory used by Bowlby who proposed inborn mechanisms in the infant such as crying or smiling which released species-specific maternal behaviour (Gewirtz 1976). Bowlby assumed that the mother's behaviour became organised around her infant, but Gewirtz proposed that each responds differently

to the other's behaviour (Gewirtz 1976). He describes two models; the first is the mechanistic model, which assumes that the behaviour can be predicted from knowledge of the antecedent material and causes for that behaviour. There is a sequential causality. Development is a quantitative change in behaviour which can be predicted from the material or efficient causes of behaviour. Experimentation is used to identify the controlling variables of behaviour. (Gewirtz 1976). The second model, the organismic, assumes that the organism is constantly changing and therefore can't be predicted and analysed as sequential causality but as reciprocal causality. The mechanistic model assumes that one member of the dyad is assumed to be constant (independent variable) and its effect on the other is assumed as sequential causality or unidirectional effect, while the organismic model assumes that the observation is of simultaneous bi-directional or simultaneous unidirectional influences. The latter theoretically precludes the study of interaction because two simultaneous events can't be observed at the same time. Gewirtz then outlines some studies of how this problem was overcome and dyads described (Gewirtz 1976). The transactional model described by Blurton Jones seems to follow the mechanistic model (Blurton Jones 1976). This model assumes that the characteristics of a child can influence its environment in different ways in different situations. There is a behavioural feed-back between the mother and child (Blurton Jones 1979). He gives an example:



Blurton Jones 1979

He gives various scenarios, including: support for the mother is increased when the mother is middle class, has few children, and the father helps with them. All of these things will have a negative effect on night waking. Such theories of causality are useful to keep in mind while trying to understand mother-infant interactions.

The Mother

The observations presented below will not be complete and will cover the first twenty months or so. There is a schema at the end of the essay for the major stages of development. Their purpose is to give some idea of the quantity and quality of interactional behaviour that must be present to create attachment from the infant to the mother, since, one assumes, that the attachment from the mother to the infant is more rapid because of the cues and emotions within the mother outlined above. This does not assume that there is not a sequential or reciprocal causality from the beginning nor that there is not a "grace period" when effects may not be long lasting, as noted above. Good mothering needs an involved, committed and responsive mother who gives her child some sense of control over his world, including her (Martin 1981). This will give the child a feeling of "effectance," the feeling that he can influence his environment. A child with low effectance from low maternal responsiveness is anxious later (Tronic 1982). A child must be a communicating being (Newson 1979). For the first three months of life, the following patterns are noted. Brazelton has described what a typical interaction is like, the sort of thing that must be analysed: there is the initiation where the mother or child vocalises; the mutual orientation where there is a neutral or bright face; the greeting with a smile (see also Papoušek 1977); the play-dialogue which is a burst-pause and the baby may grunt; and the disengagement with sobre expressions (Brazelton 1975). If such an interaction is synchronous most of the time, then there is a tone which is usually happy (David 1969), then the development will be predicted better by such observations than by early medical events or assessments (Goldberg 1980). David takes a more specific view of attachment behaviour by saying that some interactions have a quality and periodicity and tone which predominate: such patterns regulate the closeness of the pair, the maturity, intensity, quality and emotional investment (David 1969). This may be similar to the fundamental rhythms of Newson (Newson 1979) of one action and reaction each per second. Stern also mentions a tempo with limited variability for visual and vocal stimuli in a burst-pause pattern so the child can take in small bits of information (Stern 1977).

The interaction pattern depends on who starts it, how the response is made, and whether there is a signal to end or eagerness to start another sequence (David 1969). The sequences are not static, as can be expected, there is a differentiation from gross patterns to fine patterns as the baby gets older so there is the same function with more freedom. There is a "modularisation" whereby the response sequences are recombined and substitution of one response for another where the one chosen is appropriate to the goal. The responses are not in a fixed order and this is shown by placeholding where a feature of an act is retained during another, and then there is a return to the original. These combinations are described by Bruner (Bruner 1969). The feedback is not always under the child's control, the mother may choose not to respond (Bateson 1969 D), or may respond in a distorted fashion (Tronick 1982), and this can have disasterous consequences as noted above. The mother usually infantalises to fit her infant's capabilities (Brazelton 1975) and adjusts to his cues (Osofsky 1979).

During this early period of a child's life, the mother's role, aside from attending to the biological needs of her child (although even here for the biological needs, the mother tries to understand the child's cycles of sleeping and feeding so that she feels she understands her child, and feels that she can participate in his cycles by incorporating them into her schedule (Kaye 1977), is to help her infant regulate his level of arousal so that there is not too much or too little that the child withdraws (Korner 1979, Fogel 1982). The mother also helps the child attach meaning to his emotions as well (Brooks-Gunn 1982). The neonate feels "happy," "sad," "surprise," and the eight-week old adds "interest" to his repertoire (Field 1982). Such labels are derived from adult faces, which may not be applicable to a neonate. There is a more complete list in the appendix. The mother must also establish a mutuality of relationship (Biological 1969) by imposing modes of interaction which the infant can't sustain alone (Packer 1969). Mothers respond to babies as if they can communicate, and respond selectively to them by a monitoring which tries to understand what the other is "saying." She treats the baby's gesture as a social exchange by attributing to him the intention of performing an act in the correct context (Newson 1979). The

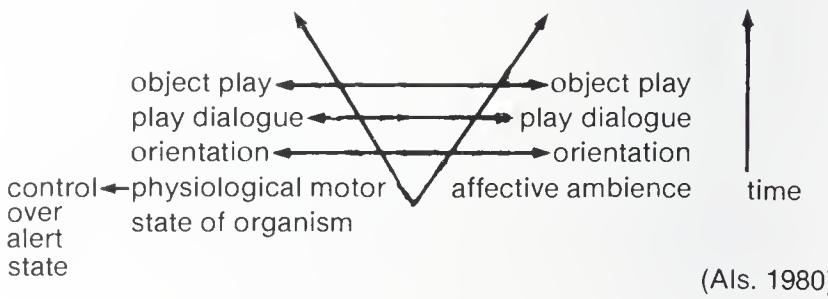
degree to which the child's behaviour becomes intentional depends on how much the mother treats it as deliberate and conscious (Schaffer 1977, Packer 1979). The mother, therefore, performs a scaffolding function (Newson 1979) or "frame" (Fogel 1977). She does this within a context of taking turns with the child who then can learn that his behaviour is of interest to his mother (see also Papoušek 1977), and so, worthwhile for him to respond (Scaffer 1977, Papoušek 1977). The mother also imitates the child so she reflects back to him his behaviour in a predictable and responsive way (Scaffer 1977, Pawlby 1977). She will let her infant get the maximum benefit from an interaction by slowing down, exaggerating and repeating her actions (Scaffer 1977, Stern 1977, Fogel 1977, Papoušek 1977), using her mouth, nose and eyes in the optimum visual field of her child: a "biological mirror" (Papoušek 1977).

The Child

The child is concerned at first with biological regulation, then his mother's response to him and his later power over her (Papoušek 1975). Osofsky has outlined several variables which have an effect on the parent: the frequency and length of periods of alert inactivity when he is available to external stimuli; whether he has a singular or global response to external stimuli; the influence of his internal state on behaviour; his response to multiple and competing external stimuli; zone reliance or choice of discharge channel; de-differentiation of behaviour; and predictable behaviour (Osofsky 1979). At the end of three months, the child can regulate an exchange and not act under immediate stimulus control. The social interactive experience will affect his mood since he reacts to the quality of what his mother is doing. His response to a still face is strongly related to his attachment at one year, and he has a feeling of effectance of a positive state by knowing what he can do and what he can't do in the interaction (Tronick 1982). The child must get the idea of reciprocity in exchange which changes later as the infant realises his behaviour has communicative value, this may be towards the end of the first year (Schaffer 1977), at the end of the second sensitive period from the fifth month to the ninth month (Sameroff 1978). The mother will use a pointing gesture to point out features in the environment of her nine-month old. This is accomplished with the old cues of looking and talking to her child, and looking at the object. The infant can follow pointing easily by fourteen months and the mother can take the lead in an interaction (Murphy 1977). Thus there might be gross patterns of initiative alternating between the child and mother larger than the small units of immediate interaction. At about twelve months, the child is likely to initiate the games which at six months the mother initiated. Such games may serve as a rough index of the infant's social skills (Gustafson 1979).

At this time (one year), memory and object permanence become manifest, as mentioned elsewhere. Now the child begins to use his mother as a secure base. Martin (Martin 1981), has observed mothers and babies at ten months, twenty-two months and forty-two months to verify the hypothesis that the child's compliance with his mother's demands depends on herself being presented as trustworthy; or the history of her child's relationship with her affects his willingness to obey her. This was found to be more true for boys. The child becomes coercive when he senses that his mother fails to cooperate with him and does not provide for his needs, or, the more responsive she is at ten months, the less coercive he will be at forty-two months. This was found to be more true for boys as well. If the mother is uninvolved, her child will force her to get involved with him and let him have his way at forty-two months. The child's trust in his mother depends on her temperament and trustworthiness. If the mother is responsive at ten months, then the boy (usually) will explore at twenty-two months and will have more interest in strangers at this time, even though they cause anxiety because the face pattern is not familiar (Stroufe 1979). Attachment is not immutable and can reach a new equilibrium, at least for middle-class mothers and children as mothers take up employment or hired non-maternal care (Thompson 1982).

By two years, the child sees himself as a separate being (Stroufe 1979), and Als gives a diagramme of this process for the first five months, a process that never really stops, but slows down by adolescence.



(Als. 1980)

Conclusion

In this paper, I have tried to give some idea of the complexity of mother-infant behaviour, from the cues used by both, especially visual cues, pre and peri-natal influences on the mother, and what happens when the cues are absent or distorted: there is compensation by other cues or aspects of behaviour. As for the physiological parameters of state, they seem to be less reliable than hoped, such as the heart rate, or may be rudimentary still such as the EEG and hormonal studies. The child is in a great state of flux for much of the first year and this makes assessment difficult, both neonatal and later. Physiology attempts to quantify those parts which are quantifiable: many researchers in this field have directly and indirectly shown how difficult it is to study dyads. There are problems with what to call that which they study, how to describe it and so theoretical models are devised to help them. There are too many variables which cannot be controlled, but we are beginning to understand the process by which one becomes an autonomous being: a mother who controls and is guided by her infant *pari passu* and an infant acting in the same way. Their behaviour must have variation within limits, a continuity of affection and sensitivity❑.

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** a 'D' after reference indicates Discussion after the paper was presented at a conference. Bracketed items refer to text citation form.*

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the
warning
signs
of
arthritis
persistent pain and stiffness on arising.
pain, tenderness or swelling in one or more joints.
recurrence of these symptoms, especially when they involve more than one joint.
persistent pain and stiffness in the neck, lower back or knees.
For more information contact
THE ARTHRITIS SOCIETY

APPENDIX

Showing the Approximate Ages of Differentiation of the Various Emotions During the First 2 Years of Life (Bridges, 1932)

					EX.						Birth
				DI.	EX.	DE.					3 months
FE.	DG.	AN.		DI.	EX.	DE.					6 months
FE.	DG.	AN.		DI.	EX.	DE.		EL.	Affection		12 months
FE.	DG.	AN.	JE.	DI.	EX.	DE.		EL.	A.A.	A.C.	18 months
FE.	DG.	AN.	JE.	DI.	EX.	DE.	JO.	EL.	A.A.	A.C.	24 months

Key: A.A. : affection for adults; A.C.: affection for children; AN.: anger; DE.; delight; DG.: disgust, DI.; distress; EL.: elation; EX.: excitement: FE.: fear, JE.: jealousy; JO.:joy.

Stroufe 1979

Month	Pleasure-Joy	Wariness-Fear	Rage-Anger	Periods of Emotional Development
0	Endogenous smile	Startle/pain	Distress due to: covering the face, physical restraint, extreme discomfort	Absolute stimulus barrier
1	Turning toward	Obligatory attention		Turning toward
2				
3	Pleasure		Rage (disappointment)	Positive affect
4	Delight Active laughter	Wariness		
5				
6				Active participation
7	Joy		Anger	
8				
9		Fear (stranger aversion)		Attachment
10				
11				
12	Elation	Anxiety Immediate fear	Angry mood, petulance	Practicing
18	Positive valuation of selfaffection	Shame	Defiance	Emergence of self
24			Intentional hurting	
36	Pride, love		Guilt	Play and fantasy

[a]The age specified is neither the first appearance of the affect in question nor its peak occurrence; it is the age when the literature suggests that the reaction is common.

Stroufe 1979

APPENDIX

Stages of Cognitive Development and Related Changes in the Affective and Social Domains

Cognitive Development (Piaget)	Affective Development (Stroufe)	Social Development (Sander)
0 — 1 Use of reflexes	0 — 1 Absolute Stimulus Barrier	0 — 3 Initial Regulation
Minimal generalization/accommodation of inborn behaviors	Built-in protection	Sleeping, feeding, quieting, arousal Beginning preferential responsiveness to caregiver
1 — 4 Primary Circular Reaction	1 — 3 Turning Toward	
First acquired adaptations (centered on body) Anticipation based on visual cues Beginning coordination of schemes	Orientation to external world Relative vulnerability to stimulation Exogenous (social) smile	
4 — 8 Secondary Circular Reaction	3 — 6 Positive Affect	4 — 6 Reciprocal Exchange
Behavior directed toward external world (sensorimotor "classes" and recognition) Beginning goal orientation (procedures for making interesting sights last; deferred circular reactions)	Content-mediated affect (pleasurable assimilation, failure to assimilate, disappointment, frustration) Pleasure as an excitatory process (laughter, social responsivity) Active stimulus barrier (investment and divestment of affect)	Mother and child coordinate feeding, caretaking activities Affective, vocal, and motor play
	7 — 9 Active Participation	7 — 9 Initiative
	Joy at being a cause (mastery initation of social games) Failure of intended acts (experience of interruption) Differentiation of emotional reactions (initial hestitancy, positive and negative social responses, and categories)	Early directed activity (infant initiates social exchange, preferred activities) Experience of succes or interference in achieving goals
8 — 12 Coordination of Secondary Schemes & Application to New Situations	9 — 12 Attachment	10 — 13 Focalization
Objectification of the (interest in object qualities & relations: search for hidden objects) True intentionality (means ends differentiation, tool-using) Imitation of novel responses Beginning appreciation of causal relations (others seen as agents, anticipation of consequences)	Affectively toned schemes (specific affective bond, categorical reactions) Integration and coordination of emotional reactions (context-mediated responses, including evaluation and beginning coping functions)	Mother's availability and responsivity tested (demands focused on mother) Exploration from secure base Reciprocity dependent on contextual information
12-18 Tertiary Circular Reaction	12-18 Practicing	14 — 20 Self-Assertion
Pursuit of novelty (active experimentation to provoke new effects) Trial-and-error problem-solving (invention of new means) Physical causality spatialized & detached from child's actions	Mother the secure base for exploration Elation in mastery Affect as part of context (moods, stored or delayed felings) Control of emotional expression	Broadened initiative Success and gratification achieved apart from mother
18-24 Invention of New Means Through Mental Combination	18-36 Emergence of Self-Concept	
Symbolic representation (language, deferred imitation, symbolic play) Problem-solving without overt action (novel combinations of schemes)	Sense of self as actor (active coping, positive self-evaluation, shame) Sense of separateness (affection, ambivalence, conflict of wills, defiance)	

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TAB. XLIX.

O The *Clavicula*.

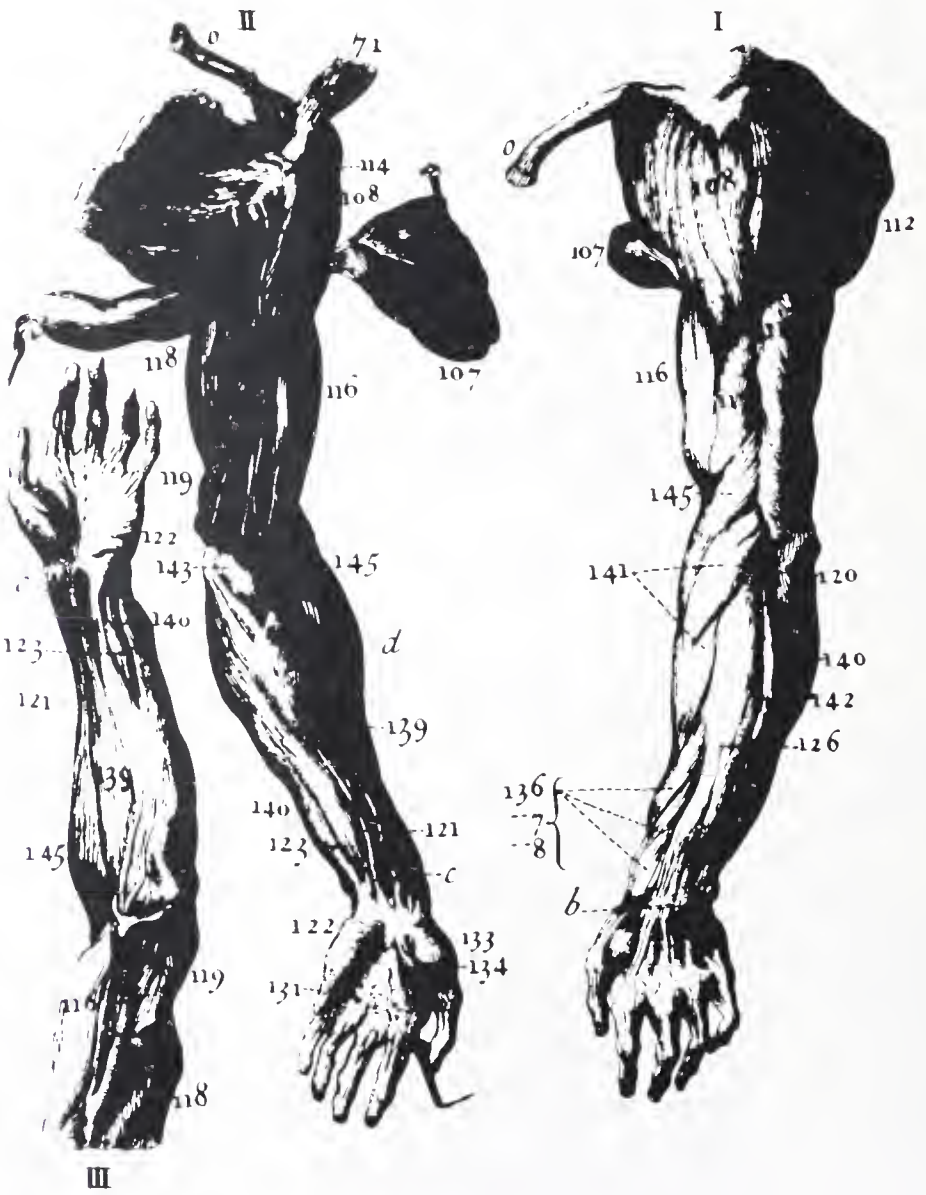
a The Blood Veſſels and Nerves of the Arm.

b The annular Ligament of the *Carpus*.

c The ſuperiour Branch of the Artery, paſſing between the Tendons of the *Supinator Radii Longus*, and *Flexor Carpi Radialis*, which makes the Pulſe in the Wriſt.

d The tendinous Expanſion of the *Biceps*.

TAB. XLIX.



W. Cowper, *Myotoma reformata*, R. Knaplock, London, 1724.

SPECIAL REPORT

The Canada Health Act: A Critique of the Consumer's Viewpoint*

Michael Cusimans 8T4, Steven L. Cusimans, R.T. Cusimans B.Sc. M.D.

The Canada Health Act (CHA) has recently passed second reading in the House of Commons and is presently at the "Committee stage" with various groups presenting their viewpoints before the House of Commons Committee on Health, Welfare and Social Affairs. The legislation will have far reaching consequences within the medical profession and society in general.

The following is a "point form summary" of the essential points in this piece of legislation. It has been kindly provided by the Hon. David Crombie.

Summary

- The Canada Health Act replaces two existing acts, the Hospital Insurance and Diagnostic Services Act and the Medical Care Act.
- The new Act sets out the program criteria and conditions of payment for the cash portion of the federal contributions made to the provinces for insured health services and payments made to the provinces for extended health care services.
- The insured health services covered by this legislation are all necessary hospital services, physician services and surgical-dental services performed in a hospital.
- The extended health care services covered by this legislation are nursing home intermediate care, adult residential care, home care and ambulatory health care.
- The criteria that a provincial health program must meet to be eligible for the full cash portion of the contribution are:

public administration: the program must be administered by a public authority accountable to the provincial government;

comprehensiveness: the program must cover all necessary hospital and medical services, and surgical-dental services rendered in hospitals;

universality: 100% of residents must be entitled to insured health services;

portability: the waiting period for new residents must not exceed three months;

insured health services must be made available to Canadians temporarily out of their own province at no extra charge to patients;

payment for services out-of-province to be paid for by the home province at host province rates;

payment for services out-of-country to be at home province rates;

accessibility: reasonable access to insured health services is not to be precluded or impeded, either directly or indirectly, by charges or other mechanisms;

reasonable compensation must be made to physicians and dentists for providing insured health services;

adequate payments must be made to hospitals in respect of insured health services.

- The conditions of payment that provinces must meet to be eligible for the full cash portion of the federal contribution and payment also include:

Provision of information: reasonable information on the operation of the program is to be supplied by the provinces to the Minister of National Health and Welfare.

Visibility: federal contributions to the program are to be given appropriate visibility.

In addition to these conditions, the Act also states that:

Extra-billing and user charges: extra-billing and user charges must not be permitted except as outlined in the regulations attached to this Act.

- Where a provincial plan fails to satisfy any one of the program criteria, or the province fails to comply with either of two of the conditions of payment (provision of information and visibility), the Act provides that the cash portion of the federal contribution or payment may be reduced. This reduction is discretionary and must be preceded by consultation with the province.
- Where a province fails to comply with the condition of payment relating to extra-billing and user charges, the Act provides for a non-discretionary reduction of the cash portion of the federal contribution by the amount charged through extra-billing or user charges.
- For the first three years after proclamation, funds withheld from provinces because of extra-billing or user charges will be held in the Public Accounts of Canada, and shall be paid to the province if the practices of extra-billing or user charges are eliminated during those three years.
- The Act will come into force, or be deemed to have come into force on April 1, 1984.

There are various arguments for and against the Canada Health Act (C.H.A.). The two main viewpoints come from the consumer on the one side, represented mainly by the federal government, and the medical profession on the other.

I will outline some of the points brought forward in an attempt to support this piece of legislation and put forth some discussion regarding these.

Presented in part to the House of Commons Committee on Health, Welfare and Social Affairs

"Medicare Is Threatened"

The main thrust behind this act is that "Medicare is threatened" which is followed up by the statement that "the small direct charges of the past are now growing and spreading" thus leading to an erosion of medicare. If one looks at direct charges, they have been present in 9 out of 10 provinces since the conception of medicare. Charges for medical services above those provided for by provincial health plans are no greater in percentage terms now than they were five years ago. Even though it may be true that hospital user fees may be spreading in certain provinces (Alberta has recently given hospitals permission to extra bill up to $20 per day in hospitals and a $10 fee for an emergency room visit), these seem to be more an indication of the degree of underfunding in the present system and an attempt to maintain the high quality of care to which we are accustomed. In fact, Alberta's Minister of Health, David Russel, has recently said that the erosion of medicare is a myth promoted by the pugnacious policies of Federal Health Minister Monique Begin. (Toronto Star, February 21, 1984). He continues to say that the Liberals have created a phony crisis in medicare to divert attention away from the fact that federal payments to the province have been steadily decreasing.

In a recent survey by National Health and Welfare Canada (summer 1983), survey respondents were asked to express their levels of concerns about six stated public issues. Ranking first in concern among Canadians was unemployment, with 73% of respondents saying they were "extremely" or "very concerned" with this issue. At the bottom of the list, behind "crime on the streets" at 58%, "protection of the environment" at 51% and "the cost of electricity" at 49%, were the two health-related issues. The cost of health care "apart from taxes" was ranked by 41% of respondents and only 31% were "extremely" or "very" concerned with the ability to get health care. It is definitely not a prime issue in Canadians' minds but it is important.

With the Canada Health Act, the federal government wants to arrest the problem of direct charges before it spins out of control and destroys Medicare completely. (statement by Hon. M. Begin on Tabling the CHA December 12, 1983). It is interesting to look at the Province of Quebec, which presently operates it's health insurance plan as the federal government would like to implement across the country (i.e., no extra billing or user fees allowed). In the survey done by National Health and Welfare last summer, Quebec respondents expressed greater concern over costs of health care after taxes (45%) than those in Ontario (43%) which is the opposite of what you would expect considering the absence of direct charges is supposed to "cure" our Medicare systems, one would expect attitudes in Quebec would be better than those in another province with direct charges with regard to major problems in Medicare. The three major problems outlined by the National Health and Welfare survey were: a) hospital bed waits (21% in Ontario say its a major problem vs. 31% in Quebec) b) extra billing (38% in Ontario vs. 23% in Quebec) and c) premiums (8% in Ontario vs. 15% in Quebec). It seems as though the outlawing of direct charges has done little to remedy the thought that "Medicare is threatened" if perceptions on Medicare are worse in Quebec than in Ontario.

"Good Health is a Right of Every Canadian"

In many arguments supporting the CHA, good health is considered a right rather than a privilege. In a statement by Monique Begin, the National Minister of Health, on November 26, 1983 ("Preserving Universal Medicare: Five Good Reasons") she said, "Good health is not just a privilege enjoyed by those who can afford it — it is the right of everyone in Canada." It is surprising to see that good health is being equated with financial access to our present system of health care delivery. It is true that direct charges weigh most heavily on the poor, elderly and those with large families (Controlling Health Care Costs by Direct Charges to-Patients: Snare or Delusion, Barer, Evans, Stoddart 1979) but is this the main stumbling block to "health" in Canadians? We think not. Marc Lalonde in his landmark paper — A New Perspective on the Health of Canadians, 1974, outlines beautifully many of the possible reasons for our ill health and perspective for the future. Prevention, especially of "lifestyle" diseases, was defined as a major goal to be achieved in improving the "health" of Canadians. A decade later, this Health Act does not even address the points of promotion of health and prevention. For example, it does not address alternate methods of organizing and delivering health care services such as the Health Maintenance Organizations in the U.S.A. which have produced savings and increased benefits for patients.

Even if good health is equivalent to universal access to our present system of health care delivery it appears as though many Canadians are and will continue to have their "right" to good health denied by the very people bringing forth the argument. The highest quality of health care is not accessible to all Canadians all of the time and therefore one can say that a right to health is being denied. The "health" act fails to address multiple problems regarding "access" which the Canadian Medical Association (OMA Review, July 1983) has ascribed to "underfunding." These are:

a) the rationing of services by queue
b) overloaded hospitals
c) larger waiting lists and longer waiting periods for admission
d) overcrowded emergency departments
e) an inability to purchase or operate state-of-the-art equipment and technology
f) staff cutbacks
g) the closing of entire wards
h) a freeze on hospital construction
i) mental patients dumped into communities with non-existant or inadequate support programs (e.g. Parkdale in Toronto)
j) a never-ending shortage of chronic care and nursing home beds
k) underserviced areas (e.g. rural and northern regions)

These problems outline the barriers to accessibility with which the CHA does not even begin to grapple.

Concerns over access to health care in the Province of Quebec (direct charges prohibited) are above those in Ontario and Canada overall (38% vs. 23% and 31% respectively). The concern over access and thus your right to health care (and presumably "health") is more than simply a financial one.

If a right is to exist, every person must have access to the right. If the right is "good health," then everyone must have equal access to it. To use the statement that good health is a right of every Canadian in defence of the Canada Health Act is an enormous overgeneralization. If Canadians are to enjoy good health they must have more than just financial access to doctors and hospitals. It is misleading to suggest that univer-

sal "Medicare" will provide good health. The only segment of the population that that appears attractive to are those who have the privilege of being in good health at any one time. The healthy person is not the one who thinks of ill health until he loses his health. It appears that good health is a privilege at present and that the introduction of the C.M.A. will not transform it into a right of Canadians.

"Freedom of Choice is a Cornerstone of our Medicare System"

We supposedly live in a free and democratic society, at least that is what our governments have been telling us since long before George Orwell's time. Apparently, freedom of choice is the cornerstone of our Medicare system and the Government of Canada has no intention of changing the situation according to a Government of Canada Position Paper on Preserving Universal Medicare published in 1983. This is a comforting thought and another apparently good reason to support the C.H.A.; on the surface at least. The Position Paper continues, "Our Constitution provides that 'health' is an area primarily under provincial jurisdiction. The Government of Canada may not regulate the delivery of personal health care services. Only provincial governments can determine how many beds will be provided, what kinds of staff will be employed and how the system will serve the public." If this is so (i.e. provincial priority over health care) then each province is in the best position to determine whether funding is adequate for their mandate. The provision of information condition for cash payments to provinces in the C.H.A. (subsection 13(a)) says that reasonable information on the operation of the program is to be supplied by the provinces to the Minister of National Health and Welfare. If the province fails to comply with this requirement to the Minister of National Health and Welfare's complete satisfaction, the Act provides that the cash portion of the federal contribution or payment may be reduced at the discretion of the Cabinet. Thus the provinces could be asked to provide information on a community-by-community, on a hospital-by-hospital, a physician-by-discipline, or a patient-by-patient basis and therefore, be subject to the ever present atmosphere or reality of financial control and direction by the Government of Canada. In a way, they could lose the freedom to administer health care delivery (e.g. numbers of beds, type and numbers of staff) in their own province because of financial control based on provision of information conditions. Perhaps this is one reason why the Provincial Ministers of Health have been so vocal in their discussions of this piece of federal legislation.

The C.H.A. will do nothing to foster the ideals of our Constitution which provides that "health" is an area primarily under provincial jurisdiction but will,rather, remove individual provincial freedom and place further control over provinces under the constant scepter of financial direction. We wonder what George Orwell would have thought of our Medicare System if this type of freedom of choice is its cornerstone.

In conclusion, the idea of free, prepaid health care is a philosophically ethical one. However, the arguments used in defence of the Canada Health Act as it now stands, have been limited in scope, and fail to provide sufficient justification for full acceptance of this legislation in its present form.

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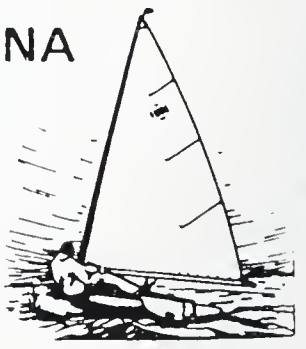
JOHNSTON MARINA

SNACK BAR



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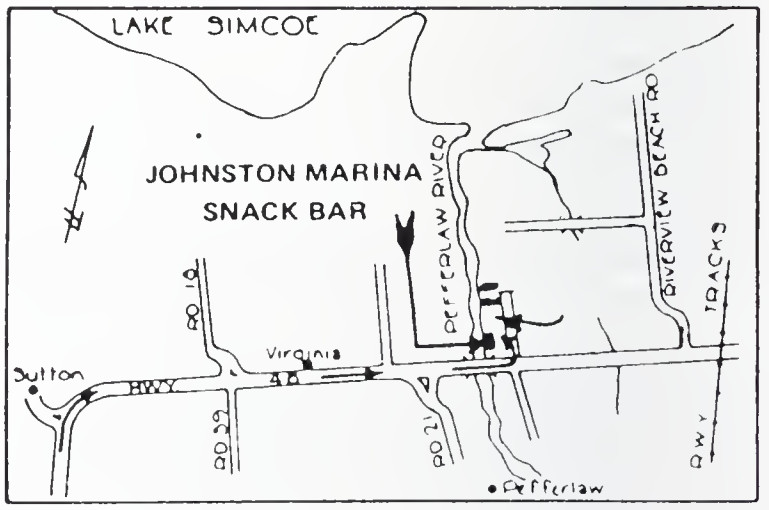

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CREATIVE WRITING: PROSE 1ST PRIZE

In the Cards

Katherine McCuaig, 8T5

"Hey, Blinky:"

I jerked around as a hand grabbed my overcoat sleeve. I had returned to Montreal on an impulse, to spend a weekend crawling through the old haunts and forgetting, if only momentarily, the crushing grind of articling. No one knew I was back. And only one person persisted in calling me by that old nickname —

"Robbie MacFadden:"

Robbie (or Robert Edward MacFadden, as the headmaster used to intone sonorously when he read the detentions out every Friday morning) was the only son of Edward C. MacFadden, Q.C., a prominent and eminently proper Montreal lawyer. His mother was in charge of the museum volunteers and the Junior League. There was money on both sides of the family, acquired far enough in the past that the grimier details were forgotten. For his ancestors, although somewhat less respectable pillars of the community, compensated for this defect by being spectacularly successful; his paternal great-great grandfather had helped finance the late nineteenth century railway boom (largely on other people's money), making a killing on land speculation in Western Canada in the process, which he promptly invested in some dubious but highly profitable public works schemes in Mexico and the Caribbean. His counterpart on Mrs. Macfadden's side had been equally enterprising if more eclectic, dabbling in lumber, establishing two breweries and a mining empire which he ran with ruthless efficiency until a carriage horse kicked him in the head and killed him.

The descendants of both prudently concentrated on preserving the respective estates. By the time Robbie was born all that remained as á memory of the sweat of the lumber camps, the raw stench of the nickel mines and the endless wheeling and dealing were several commemorative buildings at the university and a number of holding companies. For, like the lumber itself, the wily, energetic cleverness had been refined through so many generations that only a hard-headed practicality survived as a reminder of the original gusto. And that demanded instead a sober, cautious approach to life and a responsible position in the community: a profession (medicine, law, accounting), a house, memberships in squash, tennis and golf clubs, and support of the Arts, dramatic and visual. Edward MacFadden was cited in *Who's Who* for his substantial personal collection of Canadian Art.

There was no reason Robbie shouldn't have followed the same route as all his cousins and most of his friends. He was not only bright, with the tactical skills of a military general (particularly in evidence in exploits such as the kidnapping of a city bus), but had the boyish good looks used to sell breakfast cereal: unruly blonde hair, a wide grin and a mischievious glint in his blue eyes which saved him from appearing cherubic, and enhanced his palpable charm.

He was not a rebel or a revolutionary. Not only was he far too lazy, but he lacked the passion and commitment of the idealist. He just wanted to have a good time, to do what he felt like doing: playing tennis, sleeping until two in the afternoon, drinking all night in a Bishop St. bar. Robbie never confronted authority; he simply ignored it. If its demands tallied with his momentary wishes, fine; if not, he disregarded them. Neither his father's choleric outbursts, his mother's pleas nor a teacher's ultimatums moved him a whit. Fortunately for his high school career he was innately curious, and when an assignment aroused his curiosity he did it (otherwise he copied a friend's). This occurred frequently enough that he passed every year, the teacher at the time always penning with resignation at the bottom of his report that he was too intelligent to fail. Invariably his father remarked bitterly that it was more likely because no sensible person would want Robbie in his class for another year. Robbie agreed genially. It was really a nuisance having potential.

It was Robbie's honesty and complete lack of self-pity or justification which prevented him from becoming merely a jolly, self-centered prankster. Not only was he aware of his own flaws, but he was objectively fair: when he bucked the system, he didn't resent its attempt to squelch him in return. If the police picked him up as an underage drinker, or charged him when he wrapped the Chevy around a telephone pole and then couldn't produce a driver's licence, it was a nuisance, but perfectly reasonable. Of course, it didn't mean he wouldn't do it again once the legal mess was cleaned up (or perhaps before). Just as he never allowed anyone else to impose his code of behaviour on him, Robbie never tried to impose his on others. Unlike many of our high school or university friends, he never railed bitterly against his parents for attempting to pressure him to apply himself, get better marks, act more responsibly; he acknowledged, even understood their point of view. For most individuals, he agreed, the benefits probably outweighed the disadvantages. He liked luxury too. But he would inherit a sizable amount from both sides of the family, and even if his father went suddenly berserk and lost the bulk of his estate in wild speculation on the stock exchange, his maternal inheritance was safely tied up in a trust fund (annoyingly, until he was thirty). Perhaps it was unfortunate he didn't have a vocation, Robbie would explain with dispassionate amusement; but if he didn't, he didn't. Law and accounting struck him as dull, medicine and business would be too fatiguing. He preferred to play. Why not? He would have the means to do it. His father used to mutter to his friends at the tennis club bar that it gave him an ulcer just thinking about it.

Seduced by his personal charm and live-and-let-live attitude, the majority of his acquaintances (particularly women) helped him avoid most of the repercussions of his escapades. He was amusingly grateful, but didn't expect it, or resent the fact that occasionally he had to take his lumps. He was certainly apolitical, probably amoral, and a bit of a scoundrel. But he was always good for a laugh.

Robbie slid into university because his parents knew the chairman of the Fund Raising Committee. He certainly had no interest in scholarly pursuits, but decided it would be more pleasant than working. After all, he didn't have to attend classes when he preferred not to (most of the time), and his father still gave him an allowance, which an employer wouldn't do. University had a distinct advantage in that as individual time tables varied, there was always someone available for squash or soccer. He majored first in English with a concentration in film (because he enjoyed watching movies and preferred not to waste any money on books), but he switched into a general arts programme when he joined a fraternity and discovered the members had a filing cabinet full of old termpapers for the brothers' use. The only reason he failed to achieve a B average with this system was that he always seemed to miss one or two Christmas examinations which threatened to interfere with his skiing. Just as he charmed hockey coaches, teachers, police officers, bank tellers, parking garage attendants, and sorority girls, he charmed the authorities in Student Affairs. Every year for four years he was on probation; but every year he was allowed to continue. He said later that he graduated with the lowest grade point average in McGill's history.

He discovered the first passion of his life in third year: bridge. I forget who first taught him the game; it might have been one of his tennis club buddies, playing between matches in the lounge one Saturday afternoon, or a "union hack," one of a myriad group of aimless characters who floated about the student union, writing the odd article for the newspaper, smoking dope in the radio station, chugging beer in the pub. I was one of the drones, hellbent on law school, so I saw Robbie only at odd parties or on the ski hill; at school I was in the library. But even I saw the change. He played incessantly, everywhere, with anyone willing to take a hand — his parents' friends, frat brothers, ski bums. He assimilated what seemed to me to be unbelievably complex rules and stratagems effortlessly. Every afternoon found him hunched over an arborite table in the half-deserted cafeteria, surrounded by empty styrofoam cups and a full ashtray, studying the cards with frowning intensity. He was not a conventional player. He was daring, sometimes foolish (of which several appalled, cautious partners accused him on more than one occasion) but his memory, which consistently failed to retain birthdays or examination dates, was flawless when it came to remembering various hands and plays, and his style, if unpredictable, was brilliant. I once saw him win a bid of three-no-trump with a hand containing only seven points. His opponents didn't talk to him for two days.

He was soon too advanced for the university "Sunday crowd" — he craved the intellectual challenge which only serious, experienced players could provide. To his parents' astonishment and his friends' bewilderment, he joined two bridge clubs, playing four times a week with a motley collection of middle-aged housewives and retired couples interspersed with a few businessmen. He began to enter tournaments, first locally, and then gaining confidence, nationally. In the summer of third year, while he was supposed to be coaching tennis, he played bridge continually on the clubhouse deck. By November of fourth year he was out of town one week out of every three, and it was due to the contents of the fraternity filing cabinet that he managed to limp through the final term at all.

As far as his father was concerned, it was the last, brittle straw. To be able to play bridge properly was a social obligation, like attending church at Christmas and Easter, hitting a tennis ball with some style, and becoming knowledgable about the books on the *New York Times* bestseller list. It was not, he informed his son bitterly, a career. This proved what he'd always suspected: Robbie was just a damned dilettante. If he wanted to go to hell with a pack of playing cards, that was his business, but Edward wasn't footing the bill any longer. He had paid through the nose to push Robbie through high school and university, and all Robbie had ever done was embarrass him. Enough was enough. And since his grandfather's trust didn't end until his thirtieth birthday, his father finished triumphantly but unnecessarily, Robbie could get out and try it if the life of a Mississippi gambler was so damned appealing. Good riddance.

Robbie, being Robbie, didn't resent the bitter accusations flung at his head; on the other hand, he felt no guilt over failing to live up to his parents' expectations. But the Old Man's position put him in a bit of a quandary. The free ride was over, abruptly and irrevocably. His father refused to pull one string or make one telephone call to get him a cushy job, and he was unlikely to get any employment on his own merit other than moving boxes or delivering pizzas. He was reasonably adept at squash, raquetball, tennis, and skiing, but lacked the training or self discipline to teach the sports. He idly considered becoming a gigolo, but he had no idea how to begin such a venture, and it seemed like too much work. Clearsightedly, without self-pity or regret, he realized that the only skill or talent he possessed was an ability to play bridge. He had a feel for the cards and a creditable style. If he went professional — entered tournaments for money — he might be able to support himself quite pleasantly, travel around North America, and play cards. What more could he ask of life?

His father could have told him, but Edward wasn't speaking to Robbie by that point. I lent Robbie three hundred dollars to cover expenses at his first few tournaments; he promised to repay me in installments when he had the cash (Robbie always kept any promise he made — however, he rarely made any). The money dribbled back, every few months, often with a note attached: he was doing quite well, expenses were high, travel was interesting, bridge was still fun. I was accepted into law school, and promptly immersed myself in the grind, working harder than I ever had before. The volume was almost overwhelming. I had once thought this to be the end of the road, the point at which I could relax and stop competing, but now a good articling job and a position in a prestigious firm came into focus and were dangled, tauntingly, before me and my classmates. I rarely thought of Robbie, except in a rather amused way when I received an outlandish postcard from Orlando or Rochester, or listened to his father speak at a Law Society dinner.

I hadn't heard from Robbie in over eight months, and hadn't actually seen him in close to five years. Yet suddenly, here he was on Sherbrooke St., laughing and gripping my arm. His hair was shorter, neater, but still curly, with no sign, I noted enviously, of a receding hairline. His grin seemed broader, perhaps because the creases in his face were deeper. But the change in his clothes was most startling: gone were the rugby pants, the old runners, the tennis shirt. His brown suit was elegant and expensive, the tie muted wine silk.

I stared at him like a mother superior inspecting a novitiate sporting a sequined dress. "What," I demanded, stunned, "happened to you?"

He tried to repress a laugh and choked. His eyes glinted with the old, familiar puckish expression as he responded with mock solemnity. "I've become respectable."

"Impossible."

"I almost didn't tell the old Man. I was worried about his heart."

I laughed this time, as he gripped my arm again. "Look, I'm not meeting my wife for a couple of hours —"

"Your *wife*!"

"— and you'll have to come along for a drink if you want the whole story, because it's too long to tell you in the middle of the sidewalk. It's a very amusing one," he confided, as he pulled me up the steps of the Four Seasons, past an impassive bellhop, and settled into an overstuffed chair. "But you'd better order a drink — a double." For the first dozen or so tournaments Robbie barely had won enough to pay for his motel rooms, food and gas (he owned an old VW bug), and had seen most of Ontario, Upper New York state and a sizable part of New England before he had his first major win. He didn't become discouraged. He enjoyed the variety: the grubbiness of Rochester and Syracuse, the satisfied respectability of Southern Ontario, the skiing at Jay Peak. His game improved: his judgments became cooler, less erratic; his analytical cunning more disciplined and incisive. He learned new strategies from his opponents, and then ruthlessly used their own tricks to defeat them. Singlemindedly he played to win, for he found in the cutthroat world of professional bridge an irresistible mixture of chance and intellectual challenge he had never before experienced. Win he did. By the end of the first year he had climbed to be one of the top players on the circuit, with several thousand dollars in the bank — not enough for a BMW, perhaps, but certainly plenty to take him down to frolic in Ft. Lauderdale.

The third night after his arrival he met the geologist in the hotel bar. A pale, garrulous man with a bushy gray beard, he had failed to pick up any of the half-dozen or so single women clustered in his vicinity, and so decided to spend the evening telling Robbie his adventures. He had spent the last seven months surveying for a small prospecting firm in the Yukon, and was full of stories of drunk Indians and grizzly bears, which grew more rambling and incoherent as the evening progressed. With the ferocious intensity and self-conscious clarity of a man partially drunk, but not stuporous, he confided that a little known company had just staked the claims for a uranium mine within spitting distance of the Alaska highway — he'd met the geologist involved himself — which, if it panned out, could be one of the richest in the world. Of course, nothing was a sure thing. But he had bought several thousand shares himself the minute he came out of the bush...

Robbie had received hot tips in bars before, but there was something about the sincerity of the fellow which impressed him. He probably wouldn't have acted upon it, however, but for a rather fortuitous circumstance: he ran into a local stockbroker at a volleyball game on the beach the following evening, and so casually asked the broker to buy him three hundred dollars worth — twenty thousand shares at fifteen cents apiece.

He had almost forgotten about it when the news hit the front page of the *Northern Miner* two weeks later. The stock began to climb. The *Financial Post* ran a five inch column on it: the mine was everything its promoters had promised. Robbie watched in bemused wonder as the Toronto Stock Exchange went wild: 83¢ a share, $1.10, $2.30. . . at $23.80 he sold a thousand shares and bought a new Camarro.

Playing the stockmarket, he was startled to discover, was even more exciting than playing bridge. The latter had taught him how to think fast under pressure, to act decisively, and to gamble on a big win — yet, paradoxically, how to cultivate patience, not to lose his nerve, to give away several tricks to win the rubber. As a training programme for stock manipulation, it had no equal. But there was more involved than mere training: he had a gambler's instinct, a feel for the market which couldn't be taught in any MBA course. Perhaps it was a recessive gene, passed down through both sides of the family from the two disreputable schemers who had founded two fortunes and several commercial empires between them.

Robbie proceeded to hone his market skills the same way he had polished his bridge skills: practising. He acquired a knowledgeable broker whom he telephoned daily, he sold short, and religiously checked the New York quotations in the afternoon newspaper. He had no interest in the blue chip stocks which appealed to his father — you couldn't make a fortune playing those, he told me scornfully, just maintain one. It was the slightly shady mining companies, the new, scrambling, high tech, industries on which he speculated. Engrossed with this new sport, he began to play fewer tournaments: when travelling from city to city, it was a nuisance trying to stay in touch with a broker.

Like an eleven year old boy on his first pair of skis, he was coasting, dizzy, exhilarated, and seemingly inviolable, when the radio advertisements reminded him that tax time was approaching. Reluctantly he gathered together what skimpy records and receipts he had collected and blithely dumped them in the hands of a reputable accounting firm. The final figure they produced, like a series of moguls in what had seemed to be a straight hill, sent him tumbling, shocked and sore. How could the government possibly consider everything he earned to be capital gains? It was his income, he protested — damn it, he didn't even have a salary. The accountants were sympathetic but unmoved. Robbie, they pointed out patiently, hadn't taken advantage of any tax dodges, legal or otherwise. He hadn't even bought an RRSP! What did he expect? Not, he responded sourly, having to unload hastily several thousand shares of a fast-rising transport company to add to an already overfilled political pork barrel. Never had he sounded more like his father.

Winded, dishevelled, but unbowed, he learned one important lesson from his confrontation with the tax department: money-making and money management were two quite different talents, and while he excelled at the former he failed abysmally at the latter. An architect is rarely a competent building manager. If Robbie's financial edifice were going to survive,he needed an efficient accountant and bookkeeper. Moreover, he now impulsively planned to move to Florida: taxes were appreciably lower, and the climate was warmer.

After some preliminary enquiries he discovered his prospects were bleak. Uncle Sam was no more impressed with gamblers than his father. He decided to mull over his problems on another extended vacation in Ft. Lauderdale.

He found his solution teaching surfing. Isabel had studied commerce at the University of Chicago for two years, but had quit upon the realization that she lacked both the desire to work for someone else's company and the ambition to be a tycoon herself. Moving to Florida on a whim, she had worked as a waitress for a few months while learning to surf; now she taught the tourists, which enabled her to be on the beach all day and still bar hop in the evenings. As easygoing and happy-go-lucky as Robbie, she was, in addition, well organized. Her mind, he could see, was as quick and incisive as his own. Fifteen minutes after meeting her he made what most would consider to be the most reckless offer of his career yet: U.S. citizenship, $20,000 a year to manage his affairs, and all reasonable expenses paid, including room and board. She agreed.

It was one of the best bargains Robbie ever struck. Isabel not only organized his books and the daily administration of his business affairs, but worked out several investment schemes whereby he saved over $15,000 in taxes alone. She supervised his accounts, and then sparked his interest in land speculation and real estate. When the boom hit, they made a staggering profit on some condominiums just south of Ft. Lauderdale.

She was the best buddy Robbie had ever had. He had always enjoyed female company, but his previous girlfriends had always tried to reform him, to change him into someone more sober and responsible. Isabel didn't. She had the same Peter Pan approach to life. Trading snide observations at cocktail parties, squabbling over a baseball game, wolfing down coke and steamies in a pinball arcade, they became an inseparable pair. As it had never happened before, it took Robbie four months to realize he had fallen in love with her, and another two weeks to discover she loved him in return. And their sex life was spectacular.

It was an old-fashioned desire to introduce his wife to his parents and patch things up with his father which brought him back to Montreal this time. The prodigal son was returning in triumph: with all his investments, he was close to being a millionaire. Edward was torn between overwhelming pride and admiration and overwhelming resentment. He couldn't even rely on Robbie to be a failure. Even when he finally did what was wanted of him, it wasn't expected: proof positive that his son was, and always would be, contrary to the last.

"There's Isabel now," Robbie finished abruptly, looking towards the door of the bar. "She's ten minutes early — we weren't supposed to meet here until four-thirty."

I looked up to see a tall blonde weaving her way towards our table. She had classically even features and a sensual elegance which had every man covertly watching her from behind his drink. Her eyes were sparkling as her glance settled on Robbie — she obviously adored him.

Robbie waved over the waiter, and slapped a credit card on the bill: American Express Gold. As I stared at it, I thought of everyone Robbie and I had known, first at high school and then at university, who had planned so earnestly, calculated so shrewdly, worked so industriously, lived so cautiously, covering all possible options, to get what he wanted: the political science student who had made it into law, and now couldn't find an articling position; the biology major who had sweated first over medical school, then clerkships, internships and residencies, but couldn't find a hospital appointment; and the MBA graduate without a job. Even myself. I had the articling job I'd always wanted, with a prestigious Bay St. firm — but would I be asked back to work for them? And finally, what about the countless souls who organized their personal lives so efficiently, so thoroughly, sharing flats and agonizing over their psychological needs, making sure their chosen mate had common interests, common friends and common goals, before they made the most tentative commitment — and then watched, helpless, hurt and confused, as marriage after marriage splintered apart with the least bit of stress, like dried brittle pages of an old book crumbling under your fingers as you turn them.

By any moral standard, any reasonable, logical approach, it was they who should have come out on top, flaunting achievements—not Robbie, the heedless, reckless, lazy scapegrace, who had never given even a merry thought to the future, who defied every sensible precept and courted failure with the same gay insouciance he enjoyed success. But it was Robbie who had it all: a beautiful, devoted wife, work he loved, youth, health, and money. If I had any sense of what was fitting, proper and equitable, I knew I should probably have railed against the rank injustice of the world, roundly cursing whatever gods there are for their mischievous, incomprehensible, misplaced morality.

I couldn't help myself. I began to laugh, harder and harder, until I was gasping for breath. Robbie looked at me quizzically, a puzzled smile hesitantly pulling at the corners of his mouth. He followed my glance down to the AmEx card and, misunderstanding my mirth, his expression cleared. "Do you know what I've learned from all this?" he whispered conspiratorially, then paused until I was silent and he had my full attention.

"Being successful is a lot of fun," he intoned solemnly.□

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FIRST PRIZE

Song for the Lonely Moon

"How was your old friend?"
"He sought only me."
In the sad hotel
On the edge of the sea.
She asks where he went
"I tended the beach"
The moon is rising
And waiting to teach.

The yellow dress fallen
Empty upon itself
The body of a saint
Taken as he knelt.
One shoe on its side
Like a ship forsaken
The other like a step
That never was taken.

"Where go you, love
So early in the morn?"
"Where goes your love
That you teach me and scorn?"
"Oh sun, why haste
When once you did tarry?"
"Oh moon — you are dead
And I need to be married."

He stares at the bed
That imperfect forge
Of the broken heart
And all that it stores.
And the looking glass polished
By the grain of the sky
Gathers the gazing
Of all who will die.

They say that the moon
Is the face of the one
Who was never quite finished
And never begun.
She sits by a window
For her savior, I'm told
She sings each night
Each night she grows old.

Stephen Starr 8T7

SECOND PRIZE

Just Like a Chambermaid

At nineteen, as a chambermaid
I cleaned eighteen rooms a day:
Scrubbed toilet bowls and arborite desks
Left plastic cups on a tray.
A paragon of cleanliness
The housekeeper had said —
But every night when I came home
I crawled into an unmade bed.

So why should it seem odd to find
The man who drills us mercilessly
On history-taking skills:
Duration, radiation,
Frequency and type,
Six-life, occupation,
Cigarettes or pipe,
With an obsessive lust for detail
He picks the patient's brain ...
He's taught me now for sixteen weeks
And never asked my name.

Katherine McCuaig 8T5

THIRD PRIZE

Into the Warzone

Neon night in this
Winter-spring
Darkness
Exploding about us

Strolling past
Mutants
And beasts
With cavernous
Eyes
Packs of young ones
Old, reeking, toothless
Prophets
Harloty, saggy
Whores

Into the moving
Matrix
Perpetual motion
Shrouded in colours
From nightmares
Grainy French
Films

Always the neon
Matrix
Moving

Strolling, searching
Topmted by tribal
Rumblings

Into the warzone.

Lindsay Kathleen Davidson 8T6

COMMENTARY

On Entering Clerkship

David J. McNeely, 7T1*

The Oxford Dictionary of English Language (unabridged), Leland Publishing Company, London, 1968, defines the noun CLERK as "a subordinate employed to make written entries, keep the accounts and the correspondence of a department, court, corporation, or scholarly society". The adjective CLINICAL is defined as "of or pertaining to the sickbed". Hence, when one describes one's current position in the medical hierarchy to a non-medical acquaintance as that of a "clinical clerk", the impression conveyed is clear and somewhat demeaning. The title suggests a poorly paid, ink stained menial whose only role is to stand at the bedside making copious records of a patient's fluctuations in bowel and bladder habits. Oh, how far from the truth! Or is it? Overcoming the unfortunate implications of one's title "clinical clerk" is but one of the challenges one must face on entering clerkship.

From my own medical school recollections and from my experiences as an undergraduate teacher, the four years of undergraduate medical education are neatly subdivided into three phases. These three phases complete the metamorphosis from layman to physician. The first phase is the pre-clinical basic science portion of the Year I and Year II curriculum. The incredible mass of extraneous bioscience detail one is asked to assimilate serves to weed out those not totally committed to the profession; much as a bad fraternity initiation ritual. Only three individuals must know anatomy in minute detail, God, practising surgeons, and first year medical students. As an internist I am "none of the above". I freely admit I cannot recall the blood supply of the phrenic nerve. The second phase of undergraduate metamorphosis is bedside clinical instruction in Year II and Year III. This was for me the most pleasant phase of my undergraduate experience. Exposure to a cadre of enthusiastic, scholarly, yet empathetic bedside clinicians indelibly imprints the practice patterns and attitudes of a student healer. Although not without its stresses, this second phase of undergraduate education is a unique period of medical adolescence. One can ask "deep" and unanswerable questions of one's bedside instructors without fear of appearing silly. "What teleological or adaptive advantages are there to a 28 day menstrual cycle as opposed to a 40 day or 60 day cycle, Dr. Uterus?" One can be appropriately appalled at the frequency of the iatrogenic medical illness; secure in the knowledge that you yourself will never make such errors of medical omission or commission in your subsequent practice years. You can observe with a scholarly detachment the happy or unhappy outcome of patient care matters without the weight of being personally responsible for the patient. This halcyon summer of undergraduate life comes to an abrupt end on entering your clinical clerkship.

Despite the fact that the clinical clerkship approach to the 4th medical year has been extant at this university for nearly 15 years, it remains a schizophrenic experience. The clerk is still a student. Yet he or she clearly crossed the boundary from simply being a student of the healing arts to being a provider of health care. This contradiction in roles, that of student/physician, exists at other levels of post-graduate medical education (i.e. internship and residency). Nowhere, however, is this role confusion more difficult to rationalize than at the level of medical clerkship. The intent of this unavoidably anecdotal editorial is to provide an undergraduate readership with some simple observations and suggestions as to how to survive and even prosper during the clerkship year.

It is essential for the new clerk to understand his or her exact position in a teaching hospital hierarchy. The various members of the "Clinical Care Team" are represented in Figure 1. Authority and control flow in the direction indicated by the arrows. Let us examine the capabilities and characteristics of some of these authority figures that hold sway over the clerk.

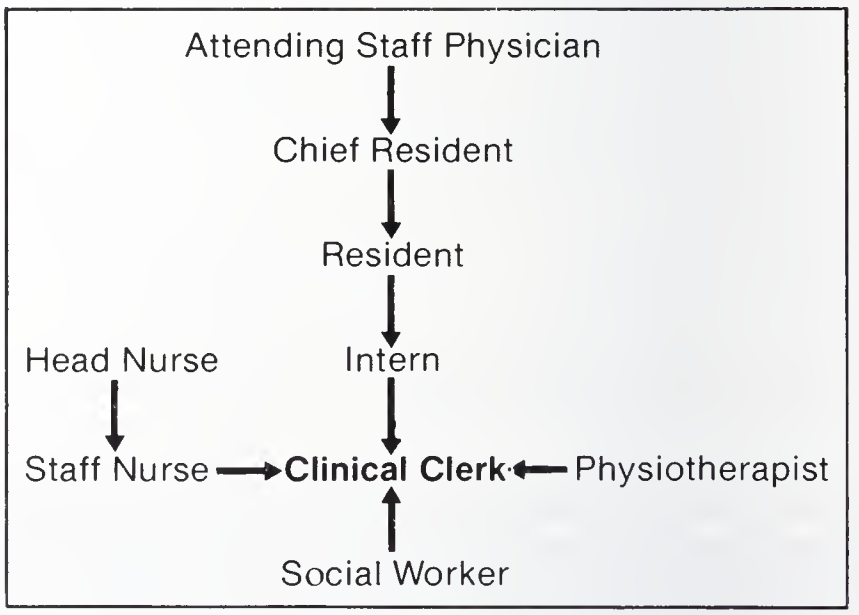

Fig. 1 The Clinical Care "Team".

ATTENDING STAFF PHYSICIAN: Leaps tall buildings in a single bound. Is more powerful than a locomotive. Is faster than a speeding bullet. Walks on water. Discusses policy with God.

CHIEF RESIDENT: Leaps short buildings in a single bound. Is more powerful than a switching engine. As fast as a speeding bullet. Chats with God.

RESIDENT: Leaps short buildings with a running start in favourable winds. Is almost as powerful as a small yard engine. Is faster than a BB. Walks on water (in a wading pool). Talks with God if a specific request is approved.

INTERN: Barely clears a Quonset hut. Consistently loses a tug-of-war with a locomotive. Can fire a speeding bullet. Swims reasonably well. Is occasionally addressed by God.

STAFF NURSE: Makes high marks on building walls when attempting to leap them. Is run over by locomotives. Can usually handle a fire-arm without suffering self-inflicting wounds. Treads water. Talks to higher vertebrates.

PHYSIOTHERAPIST: Can climb walls of reasonable height. Rides the rails. Plays Russian roulette with handguns. Walks on thin ice. Prays a lot.

SOCIAL WORKER: Runs into buildings. Recognizes locomotives two out of three times. Is never issued live ammunition. Can float on water only with the aid of a life belt. Talks to walls and other inanimate objects.

CLINICAL CLERK: Falls over door sills when trying to enter a building. Refers to locomotives as "Da choo-choo." Wets himself with a water pistol. Plays in shallow puddles. Mumbles unintelligibly to himself.

HEAD NURSE: Lifts tall buildings in order to walk under them. Kicks locomotives off the tracks. Catches speeding bullets in her teeth and chews them. Freezes water with a sideways glance. She is God!

The clinical clerk must then quickly adapt to this natural order of medical life "at the bottom of the food chain." To survive he or she must be intellectually quick, constantly vigilant and when occasion demands, a master of camouflage. The system is well ordered and changeless. Those who rail against it are not well received.

Recently one of our hospital's newly arrived clerks demonstrated the kind of maladaptive behaviour that is to be avoided at all costs. At a staff/housestaff social hour, emboldened by two light beers, the clerk told one of the very senior attending physicians, "there is only one place in this damn hospital I can sit down and feel self-assured and in control. . . but that seat hinges upward." His listener was not amused. This was a bad start to his clerkship! Once again mental quickness, constant vigilance and the skillful use of camouflage are the attributes of the successful clerk.

Mental quickness is a difficult terminology to define. It is not necessarily dependent on the prior mastery of a large volume of medical facts. It is rather the demonstration (at the bedside or in teaching rounds) of an ability to cut through extraneous detail and come quickly to the key elements of diagnosis or therapy. There are not enough hours in the clinical day to allow endless rumination over medical trivia. When presenting the history of a recently admitted patient on ward rounds, this attribute is particularly valuable. The clerk who presents his findings in a concise, succinct, and word-efficient fashion will be described in subsequent evaluations by his resident or staff man as "sharp" or "bright." Conversely, an overly thorough obsessional presentation of bedside findings by a clerk will, at best, result in an evaluation peppered with neutral descriptives such as "dependable" or "hard-working." This is not to say that sloppiness or medical shortcuts are encouraged or rewarded in the course of one's clerkship. Quite the opposite is the case.

I view with concern the increasingly complex and undecipherable anagrams that clinical clerks delight in employing when they record their histories and physical findings in patients' charts. I recall recently when one of our city's unfortunate "bag ladies" was brought to the Emergency Room, the admission note read:

Mrs. X ?60 yrs
Hx - HBD, FIP, ?LOC
Px - LOL, NAD, NAB
Rx - CT, STAT PP's

A rough translation of this coded information would be as follows: The patient is a female in her 60's. She had been drinking. She was found in a public park. There is some question of an episode of loss of consciousness. On physical examination she presents as a little old lady in no acute distress. The only other physical finding noted is a deficit in personal hygiene. (She needs a bath). The plan of management includes computerized axial tomography of the cranium and the urgent completion of social service placement papers. This distillation of the patient care information to a few scribbled anagrams is *not* evidence of mental quickness. It is evidence of sloth.

A second attribute of the successful clinical clerk is constant vigilance. Being the most junior member of a complex medical hierarchy the clinical clerk is vulnerable on all sides. The traps and pitfalls are many. Beware of the lazy intern who wants to sign out to you leaving you responsible for 12 desperately ill patients, none of whom you know well. Beware of the compulsive nurse who wants a standing H.S. order for a potent hypnosedative on all newly admitted patients on her ward. Such drugs are often poorly tolerated by elderly infirm patients. Most of the glaring medical errors committed by clinical clerks and reported to the attending medical staff occur in this sort of setting. The clinical clerks should carefully avoid those situations where he or she is asked to assume duties and responsibilities that are beyond his or her level of expertise and training.

Equally importantly the clerk should be constantly alert to the dangers of making a social faux-pas. A certain amount of youthful exuberance and rebelliousness is tolerated by the hospital's medical hierarachy. A gross breach of social conduct by a clinical clerk can be as deleterious to his or her career as a catastrophic medical error. Do not criticize or belittle your senior resident on ward rounds; even if he did steal your brilliant and insightful diagnosis on a difficult case and then misrepresented it as his own. Do not make open and disparaging references to the head nurse's weight problems (Miss Thunder Buns). Head nurses are omnipotent and can see to it that you never practice in the English-speaking world (no slight to Quebec intended). Never reveal which senior staff surgeon you glimpsed with which radiology technician in the coffee shop of the "Notel Motel" late last Friday night. The hospital rumour mill is constantly turning. Should a clinical clerk be traced as the source of a particularly nasty (albeit completely verified) rumour the clerk is likely himself to become grist for the mill.

Lastly with reference to the attributes of the successful clinical clerk we come to the mastery of camouflage. The successful clerk does not have to be a brilliant, decisive, scholarly humanist. He just has to look like one. Senior staff expect their clerks to appear callow, insecure, and unworldly. Hence the clerk who contrives to appear sophisticated, quietly

self-confident, and mature stands out from his peers. The stratagems employed by previous generations of clerks to camouflage their insecurities are legion. I mention only some of the more successful ruses. Present yourself at the staffman's rounds in a clean pressed lab coat with only the thinnest of pocket note books in the breast pocket. You instantly stand out from the other house officers. Their filthy lab coats bulge with pocket references, texts, and "cook books" of medical care. The implication is obvious. The medical knowledge that your pedantic colleagues have to carry in lab coat saddle bags full of paper, you have long ago committed to memory. Quickly determine the research interests of the staffman. Read all his boring papers. Then you can subtly direct bedside discussions into those fields so that your shared interest and enthusiasm for, say bile salt metabolism, is brought to the staffman's attention. Better still, contrive to quote his papers in the context of these directed discussions.

Equally important in these camouflage manoeuvres is the demonstration of social and cultural maturity. Find out if the chief medical resident has symphony seats (chief residents have lots of money these days). Find out where his or her seats are located in the hall. Reserve seats nearby. Arrange to bump into the good doctor on your way in, at intermission, and on your way out. Hint that the performance was not as good as the one you recently heard in New York. Let's say you discover that your staffman is dabbling in the stock market (staffman do not have lots of money these days). Read a little bit about the market. Work a few pithy references about current market trends into your clinical banter. "Mr. Stunt's BP is falling faster than Bolivian tin futures". To be completely successful the clinical clerk's camouflage must be balanced and subtle. Do not overdo it. Several years ago a clerk, desirous of an academic career in respirology, discovered that the Respirologist-in Chief in his hospital was a fanatical jogger. The clerk took up the sport and was frequently seen discussing equipment and technique with the senior respirologist. Later that year this foolish youth bested the service chief by 45 minutes in a local marathon run. The clerk in question is now an ERP (Emergency Room Physician) in rural Saskatchewan.

To recapitulate, the clerkship as currently constituted is an unavoidably schizophrenic mixture of medical learning and doing. The medical hierarchy is highly stratified. The beginning of knowledge for the clerk is the recognition and acceptance of "the system". Through a combination of mental quickness, constant vigilance, and subtle camouflage, "the system" can be bested. The tone of this review has been purposely light. I am convinced that too much has been made of the demands and stresses of the clinical clerkship. It is not simply a year to be endured "at the wrong end of the medical drain pipe". It can be and should be an exciting rewarding initiation into the healing profession. So those facing the clerkship should banish their fears, except the petty inequities of "the system" and be prepared to enjoy their clerkship; because the internship year if you can even get one, is absolutely the "PITS"! □

* *Dr. D.J. McNeely, M.D., F.R.C.P.(C) is an Assistant Professor of Medicine and of Medical Microbiology at the University of Toronto. He has published on many topics of Infectious Disease including: Infections in the Immunosuppressed Host, Drug Utilization, Antibiotic Surveillance, and Septic Schock. He is currently Staff Physician and Director of Division of Infectious Diseases at the Toronto Western Hospital.*

Shattered Dreams

Not long ago, many said Bill had it made. Wonderful family, new home, recent promotion and oh yes, he even found time for squash twice a week. Much of that changed the day his car was involved in an accident and he broke his back. Yes, he had forgotten to fasten his seatbelt.

Each year, a careless moment turns an everyday activity into a nightmare for thousands of Canadians like Bill. Many will never walk again, their lives forever altered. Almost as tragic as the physical and emotional trauma, is the knowledge that most spinal cord injuries could have been prevented.

As a paraplegic, Bill's learning to cope with his paralysis and the changes it brought about in his life. The spinal cord injury he sustained is like that suffered by many young adults... Too many young adults. The Canadian Paraplegic Association says, whether you're at home, at work, on the road, or participating in your favourite recreational activity... A spinal cord injury happens in an instant but lasts a lifetime.

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Dalacin® C Phosphate Phosphate S.S.

Recommended Applications

Action: Clindamycin exerts its antibacterial effect by causing cessation of protein synthesis and also by causing a reduction in the rate of synthesis of nucleic acids.

Indications: Dalacin C Phosphate (clindamycin phosphate) is indicated for the treatment of infections where the oral route is not indicated or feasible.

Dalacin C Phosphate is indicated in the treatment of serious infections due to sensitive anaerobic bacteria, such as Bacteroides species, peptostreptococcus, anaerobic streptococci, Clostridium species and microaerophilic streptococci.

Dalacin C Phosphate is also indicated in serious infections due to sensitive Gram-positive organisms (staphylococci, including penicillinase-producing staphylococci, streptococci and pneumococci) when the patient is intolerant of, or the organism resistant to other appropriate antibiotics.

Contraindications: The use of Dalacin C Phosphate (clindamycin phosphate) is contraindicated in patients previously found to be hypersensitive to this compound, the parent compound, clindamycin, or clindamycin palmitate. Although cross-sensitization with Lincocin® (lincomycin hydrochloride) has not been demonstrated, it is recommended that Dalacin C Phosphate not be used in patients who have demonstrated lincomycin sensitivity.

Until further clinical experience is obtained, Dalacin C Phosphate is not indicated in the newborn (infants below 30 days of age), or in pregnant women.

Warnings: Some cases of severe and persistent diarrhea have been reported during or after therapy with Dalacin C Phosphate (clindamycin phosphate). This diarrhea has been occasionally associated with blood and mucus in the stools and has at times resulted in acute colitis. When endoscopy has been performed, some of these cases have shown pseudomembrane formation.

If significant diarrhea occurs during therapy, this drug should be discontinued or, if necessary, continued only with close observation. Significant diarrhea occurring up to several weeks post-therapy should be managed as if antibiotic-associated.

If colitis is suspected, endoscopy is recommended. Mild cases showing minimal mucosal changes may respond to simple drug discontinuance. Moderate to severe cases, including those showing ulceration or pseudomembrane formation, should be managed with fluid, electrolyte, and protein supplementation as indicated. Corticoid retention enemas and systemic corticoids may be of help in persistent cases. Anticholinergics and antiperistaltic agents may worsen the condition. Other causes of colitis should be considered.

Studies indicate a toxin(s) produced by Clostridia (especially Clostridium difficile) may be a principal cause of clindamycin and other antibiotic-associated colitis. These studies also indicate that this toxigenic Clostridium is usually sensitive *in-vitro* to vancomycin. When 125 mg to 500 mg of vancomycin were administered *orally* four times a day for 5 – 10 or more days, there was a rapid observed disappearance of the toxin from faecal samples and a coincidental recovery from the diarrhea.

It should be noted that serious relapses have occurred up to one month after apparently successful treatment. A relatively prolonged period of continuing observation is therefore recommended.

Precautions: Dalacin C Phosphate (clindamycin phosphate), like any drug, should be prescribed with caution in atopic individuals.

Dalacin C Phosphate must be diluted for intravenous administration. (See Dosage and Administration)

The use of antibiotics occasionally results in overgrowth of nonsusceptible organisms – particularly yeasts. Should superinfections occur, appropriate measures should be taken as dictated by the clinical situation.

As with all antibiotics, perform culture and sensitivity studies in conjunction with drug therapy.

Since abnormalities of liver function tests have been noted occasionally in animals and man, periodic liver function tests should be performed during prolonged therapy. Blood counts should also be monitored during extended therapy.

Dalacin C Phosphate may be used in anuretic patients. Since the serum half-life of clindamycin in patients with impaired hepatic function is greater than that found in normal patients, the dose of Dalacin C Phosphate should be appropriately decreased. Hemodialysis and peritoneal dialysis are not effective means of removing the compound from the blood. Periodic serum levels should be determined in patients with severe hepatic and renal insufficiency.

Adverse Reactions: *Local.*

(a) *Intramuscular Injections.* Of 404 patients treated with Dalacin C Phosphate (clindamycin phosphate) intramuscularly (with a solution containing 150 mg/mL), six (1.5%) demonstrated local reactions as follows: Two complained of pain at the injection site, two demonstrated induration at the injection site and two developed sterile abscesses.

(b) *Intravenous Infusions:* Of 192 patients treated with Dalacin C Phosphate by intravenous infusion, 14 (7.3%) demonstrated local reactions. Eleven patients developed superficial thrombophlebitis and one patient developed both superficial and deep thrombophlebitis. The majority of these cases developed in conjunction with the use of indwelling I.V. catheters and it is difficult to know how much the drug contributed to the irritation. Two patients developed localized erythema, swelling and pain at the site of the infusion.

Systemic Side Effects: Twenty-eight patients of 596 treated with Dalacin C Phosphate (clindamycin phosphate) by either the intramuscular or intravenous routes developed systemic side effects as follows:

	Number of Patients
Rash	7
Urticaria	1
Pruritus	1
Fever, Leucocytosis	1
Nausea with or without vomiting	1
Diarrhea (See also under "Warnings")	4
Hypotension	1
Hypertension	1
Shortness of Breath	1
Superinfection*	4
Cardiac arrest**	1
Bad or bitter taste in mouth	5

*Superinfection is a complication of antibiotic therapy in general and is not necessarily a true side effect of clindamycin phosphate.

**Due to underlying myocarditis in this patient.

Clinical and Laboratory Findings: Patients treated during clinical trials of Dalacin C Phosphate (clindamycin phosphate) were followed with clinical laboratory tests, including complete hematology, urinalysis and liver and kidney function tests. Some of these tests were abnormal initially and returned to normal during therapy with Dalacin C Phosphate, while others were normal initially and became abnormal during therapy. Overall evaluation of clinical laboratory values in these patients does not indicate that Dalacin C Phosphate therapy has a toxic effect on the hematopoietic, hepatic or renal systems. Transient elevations of serum transaminases have occurred in some patients, but other liver function tests (alkaline phosphatase, serum bilirubin) have not shown any tendency to increase and there have not been clinical signs of drug-induced hepatic toxicity.

Symptoms and Treatment of Overdosage: No cases of overdosage have been reported. No specific antidote is known. Doses as high as 1200 mg every six hours (4800 mg/day) by infusion for five days have been given without adverse effects.

DOSAGE AND ADMINISTRATION

Adults

Intramuscular Injection. 600 mg/day in 2 equal doses.

Moderately severe infections: 600 to 1200 mg/day in 2 or 3 equal doses.

Severe infections: 1200 to 2400 mg/day in 2, 3 or 4 equal doses. Intramuscular injections of more than 600 mg into a single site are not recommended.

Intravenous Administration: Dalacin C Phosphate (clindamycin phosphate) must be diluted prior to I.V. administration to a dilution of 300 mg in 50 ml of diluent (6 mg/ml) or more, and infused in not less than 10 minutes. Administration of more than 1200 mg in a single 1 hour infusion is not recommended. Dalacin C Phosphate should not be injected intravenously undiluted as a bolus.

Moderately severe infections: 900 to 1800 mg/day by continuous drip or in 2 or 3 equal doses, each infused over 20 minutes or longer.

Severe infections: 1800 to 2700 mg/day by continuous drip or in 3 or 4 equal doses, each infused over 20 minutes or longer. In life-threatening infections, doses of 2700 to 4800 mg/day by continuous drip or in 3 or 4 equal doses each infused over 20 minutes or longer may be given.

Dilution and infusion rates:

Dose	*Diluent*	*Time*
300 mg	50 ml	10 min.
600 mg	100 ml	20 min.
900 mg	150 ml	30 min.
1200 mg	200 ml	45 min.

Alternatively, drug may be administered in the form of a single rapid infusion of the first dose followed by continuous I.V. infusion as follows:

To maintain serum clindamycin levels	*Rapid infusion rate*	*Maintenance infusion rate*
Above 4 mcg/ml	10 mg/min. for 30 min.	0.75 mg/min.
Above 5 mcg/ml	15 mg/min. for 30 min.	1.00 mg/min.
Above 6 mcg/ml	20 mg/min. for 30 min.	1.25 mg/min.

Children: (Over one month of age)

Intramuscular injection: 10 to 15 mg/kg/day in 2, 3 or 4 equal doses.

Moderately severe infections: 15 to 20 mg/kg/day in 3 or 4 equal doses.

Severe infections: 20 to 30 mg/kg/day in 3 or 4 equal doses.

Intravenous Administration:

Moderately severe infections. 15 to 25 mg/kg/day by continuous drip or in 3 or 4 equal doses, each infused over 20 minutes or longer. In severe infections, it is recommended that children be given no less than 300 mg/day regardless of body weight. (Dilute Dalacin C Phosphate Sterile Solution in the same manner as for adults.)

Dilution and Compatibility:

4 ml (600 mg) Dalacin C Phosphate when diluted with 1000 ml of the following commonly used infusion solutions was found to be physically compatible and demonstrated no significant change in pH or antimicrobial potency over a period of 24 hours:

Sodium chloride injection
Dextrose 5% in water
Dextrose 5% in saline
Dextrose 5% in Ringer's Solution
Dextrose 5% in half-strength saline plus 40 mEq potassium chloride
Dextrose 2½% in Lactated Ringer's Solution (Hartmann's Solution).

Dalacin C Phosphate was not stable when added to Dextrose 5% in water plus vitamins. Therefore it is not recommended that Dalacin C Phosphate be mixed with any infusion solution containing B vitamins.

Supplied:

Dalacin C Phosphate contains the following per ml of sterile solution.

Clindamycin phosphate equivalent to clindamycin base 150 mg
Benzyl alcohol 5 mg
Disodium edetate 0.5 mg
Water for injection q.s.

When necessary the pH is adjusted with sodium hydroxide and/or hydrochloric acid to maintain a pH range of 5.5 to 7.0.

Dalacin C Phosphate is available in 2 ml and 4 ml ampoules.

NOTE: Do not store below 15°C.

Product Monograph available upon request. CE 1377 1C

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Dalacin C Phosphate Sterile Solution
(clindamycin phosphate)

...the standard to which others are compared.

- Provides excellent penetration into infected abscesses.[2]
- Highly effective against gram-positive aerobes including penicillinase – producing Staphylococci.
- Highly effective against gram-positive and gram-negative anaerobes, in particular *Bacteroides fragilis.*
- After 10 years of clinical use, resistance development to *Bacteroides fragilis* is as low as 2%.[3]
- Has *never* been associated with any carcinogenic or mutagenic activity.
- May enhance the natural host defense system; has been shown to concentrate within polymorphonuclear leukocytes in vitro. These neutrophils in turn may act as an important antibiotic delivery system to the site of infection.[4]

1. R. Fekety, M.D., Drug Therapy Hospital, October 1982
   *In combination with an aminoglycoside.
2. Mouzas G.L., et al (1980) Brit J Clin Pract *34*:234
3. M.H. Yee, M.D. et al, JAMA, October 15, 1982, Vol. 248, No 15
4. M.S. Klempner et al, J. Inf. Dis., Vol. 144, No. 5, November 1981

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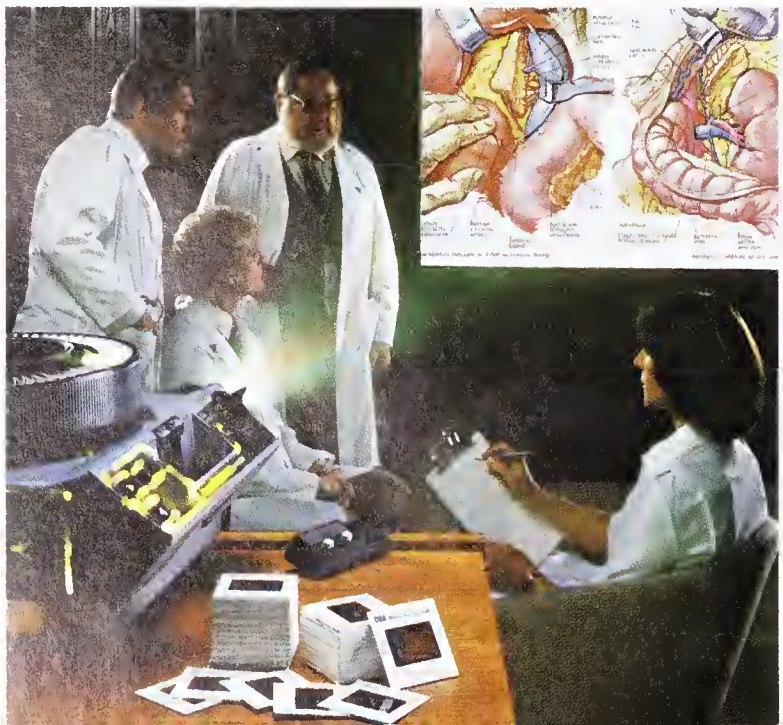

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